MR 114-6

LABORATORY REPORT

Blue Diamond Company

Date August 8, 1961

To: Mr. W. G. Bradley (4)
Mr. J. D. Herbert

General Remarks: Sample from: H. E. DeRoux
Box 1644
Juneau, Alaska
To: Mr. K. Ellsworth, U. S. Lime Products

Subject: Chichagof Island Gypsum

ANALYSIS

ACID INSOLUBLE RESIDUE	1.71
Silica (SiO_2)	
Aluminum oxide (Al_2O_3) } R_2O_3	0.06
Iron oxide (Fe_2O_3)	
Calcium oxide (CaO)	32.46
Magnesium oxide (MGO)	1.82
Sulphuric anhydride (SO_3)	44.64
Sodium oxide (Na_2O) } No	
Potassium oxide (K_2O) } determination	
Loss on Ignition	20.08
Total	100.77
Free moisture	
Water of crystallization	19.13
Combined Water	
CO_2	0.94

ULTIMATE ANALYSIS	
Sand and Clay	3.59
Hemi-hydrate Plaster	
Gypsum	91.50
Anhydrite	3.55
Limestone	
Calcium Carbonate	2.14
Magnesium Carbonate	
Hydrated Lime	
Calcium Hydroxide	
Magnesium Hydroxide	
Unhydrated Oxides	

BD 250 1/60

Chemist STUART R. GARNETT SRG

A COMPREHENSIVE REPORT _ _ _

G Y P S U M

I Y O U K E E N C O V E C H I C H A G O F I S L A N D

A L A S K A

L U C K Y G Y P S U M G R O U P O F C L A I M S

By: H. E. De Roux
Owner

May 1961
(Updated to September 1961)

IYOUKEEN COVE, LUCKY GYPSUM MINING CLAIMS, CHICHAGOF ISLAND, ALASKA

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IYOUKEEN COVE, LUCKY GYPSUM MINING CLAIMS, CHICHAGOF ISLAND, ALASKA

I. Location and Geographical Description:

The gypsum deposit at Iyoukeen Cove is situated on the eastern shore of Chichagof Island, at tidewater, adjacent to Chatham Strait in southeastern Alaska (U. S. Coast and Geodetic Survey Chart No. 8202 - approx. latitude 57°N., longitude 135°W. - encl. Index Map of Alaska pp E-2.) The cove is accessible to ocean vessels or deep draft barges. It is on a main ship channel used by vessels traversing from Puget Sound to Gulf and Western Alaska ports. It is about 80 miles inland on the main ship channel from the seaport and pulp mill city of Sitka. The harbor for the most part, has a hard bottom, excepting the northern extremity, which is muddy. A flat reef at the south point of the cove, which covers at half tide, affords some protection and could easily be built up to an excellent breakwater. The water in the harbor is sufficiently deep to require only a short pier. The only facility at the site at present, is a frame cabin, in fair repair, situated at the beach.

This property, formerly known as Camel-Gypsum, consists of ten unpatented high grade gypsum mining claims, embracing approximately two hundred acres. The claims are grouped and recorded under the name of LUCKY GYPSUM GROUP, and they are owned in entirety by Harold E. de Roux of Juneau, Alaska. The front lines of the claims commence at the high water level, near a white bluff at the southern end of the cove, and continue northward following the highwater line, a distance of three thousand feet. The side lines follow back in a southwesterly direction three thousand feet.

II. History:

Gypsum was first reported in the area in 1902 and claims at the Camel-Gypsum, now LUCKY GYPSUM, were first staked in 1910, by Arvid Anderson andRobert Greenwald, but it was not until about 1922 that any appreciable development work took place. The mine produced a small amount of gypsum around 1924. However, there are no figures available on that production, which was reportedly sold to the Pacific Coast Gypsum Company, operating nearby. Robert Greenwald later sold his interests to Dave Housel of Juneau, Alaska. In 1946 there were about 850 feet of accessible underground workings and additional 210 feet of filled or flooded workings. The reason for cessation of mining is believed to be because of the lack of the only market then available, the Pacific Coast Gypsum Company, which ceasedoperations nearby.

In 1946, the property was optioned to the Dant-Russel Company, (Fir-Tex Corporation of St. Helens, Oregon) for an 18 month period for $60,000. The Board of Directors of that firm, being primarily interested in the lumbering industry, decided that operation of the mine and entering the wall board manufacturing business would have been too great a venture for them at that time, andddecided to stay with lumber. A field examination was made in September 1946 by that company's engeneer and his report is made a part hereof under that section covering "Geology", see Section X. The holdings of the Lucky Gypsum Group were acquired by the present owner in 1951.

III. Quality:

The gypsum exposed in all the exposed places, underground as well as on the surface, is mostly pure white, although in places it grades to a light bluish gray. It is usually fine grained and translucent approaching alabaster in grade.

Analysis of various samples of this gypsum, taken from at least three different locations, made by a reputable assayer in Redwood City, California, disclosed:

	Sugar Rock	Massive
Combined Water	20.32%	20.13%
Gypsum ($CaSO_4+2H_2O$) (Calculated from combined water)	97.06%	96.20%
Limestone ($CaCO_3$)	.6%	1.2%

This analysis shows both types to be of high purity. A chemist at Seattle, Washington, after analyizing a small sample, from undergpound, advised it showed 93.2% gypsum and no anhydrite. The U. S. Bureau of Mines submitted samples in 1948 to their chemist at Salt Lake City, Utah, and his analysis is made a part hereof as Table I, following, to show the chemical content that may be expected. A laboratory report from the Blue Diamond Company out of Las Vegas, Nevada, gives the following analyses from samples submitted to them for assay in 1961:

Acid Insoluble Residue		1.71
Aluminum oxide) Iron oxide)	R_2O_3	0.06
Calcium oxide		32.46
Magnesium oxide		1.82
Sulphuric anhydride		44.64
Loss on ignition		20.08
Total		100.77
Water of crystallization		19.13
CO_2		0.94

Ultimate Analysis:	
Sand andclay	3.59
Gypsum	91.50
Anhydrite	3.55
Limestone Calcium carbonate	2.14

TABLE I.

Analysis of samples from Lucky Gypsum Group, Chichagof Island, Alaska:

Sample No.	Description	Free H_2O	Comb H_2O	CO_2	CaO	MgO	SO_3	SiO_2	R_2O_3	NaCl
1.	Blue & Brown Clay with gypsum	1.16	1.1	20.9	29.6	5.3	1.3	28.6	8.2	0.01
2.	Clay w/gyspum	.49	10.7	9.0	30.4	2.6	25.85	12.8	4.4	.01
3.	Gypsum	.08	14.9	6.4	31.9	2.2	35.0	5.6	2.0	.01
4.	Gypsum	.34	14.7	5.2	29.6	3.8	34.25	8.2	2.4	.01
5.	Gypsum	.37	11.1	12.9	33.8	3.4	26.55	8.0	2.6	.01
6.	Gypsum w/some clay	.81	7.9	12.3	29.3	3.7	18.6	17.8	5.4	.01
7.	Gypsum w/some gravel	1.08	.9	24.2	33.3	5.4	3.0	21.4	6.8	.01
8.	Gypsum w/some gravel	.71	3.7	20.6	33.3	3.3	8.15	19.2	6.4	.01
9.	Gypsum w/some gravel	1.05	1.6	24.9	35.0	5.6	3.1	19.8	6.2	.01
10.	Gypsum	.20	16.1	3.95	31.4	1.5	39.25	4.0	1.2	.01
11.	Gypsum	.09	17.7	2.70	32.5	1.0	42.2	2.4	.8	.01
12.	Gypsum seams w/some clay	.51	8.4	16.7	33.1	5.5	20.15	10.2	2.8	.01
13.	Gypsum seams w/some clay	.41	13.8	4.65	28.1	4.5	32.2	10.2	3.2	.01
14.	Gypsum seams w/some clay	.66	11.8	8.15	28.5	5.5	28.0	11.2	2.4	.01
15.	Gypsum & clay	1.48	9.8	4.75	22.1	4.5	21.1	21.6	11.2	.01
16.	Gypsum seams w/some clay	.34	15.7	2.70	29.5	2.7	37.35	7.0	2.2	.01
17.	Gypsum seams w/some clay	.72	6.5	16.2	30.9	6.2	16.05	15.8	4.2	.01
18.	Gypsum seams w/some clay	.39	15.0	3.60	29.8	1.1	36.2	7.4	3.2	.01
19.	Gypsum	.15	15.0	1.40	30.2	2.55	40.7	6.2	1.8	.01
20.	Gypsum seams w/some clay	.40	12.7	4.70	28.0	3.55	31.3	11.9	3.9	.01
21.	Gypsum seams w/some clay	.25	12.0	4.60	29.1	2.95	29.9	12.3	3.2	.01
22.	Gypsum w/some gravel	.65	6.1	13.1	28.1	2.90	15.2	21.2	7.7	.01

USBM R.I. No.4852
Apr 1952
Reprinted.

IV. Workings:

Five adits have been opened from the beach about fifteen feet above the high water mark, westward into the gently sloping bench that rises steeply from the beach at the prospect. Adit No. 1 is driven into the buff limestone breccia converging into gypsum at about twenty feet horizontally. This tunnel was later closed off and the frontend used for dynamite storage. Adit No. 4 was driven around the caved portion of adit No. 2 to open the face of the gypsum exposed in that tunnel. Additional work consists of two winzes in tunnel No. 3 with a short sub-level drift below tunnel No. 3 about forty feet. Adit No. 5 is driven into rock and brecciated limestone. The total of underground workings consists of 1,060 feet of tunnel and two forty foot shafts. The inclined winze also in No. 3 was pumped out and 11 feet 6 inches of gypsum containing clay seams was exposed. (See enclosure on "Geological Sections", of deposit pp E-6.)

V. Quantity:

It is estimated by the Redwood City assayer, from information submitted to him in 1954, that there are one and one half million tons of crude gypsum within the boundaries of the then held eight claims. In 1961, a geologist with M. A. Hanna Company and a geologist with the State of Alaska concluded there is an estimated 2½ million tons of crude gypsum in and between the exposed areas of tunnels No. 4 and No. 3. A geologist with seventeen years experience principally in gypsum, is of the opinion that is in an extensive deposit. A geologist just previously with the State of Alaska Department of Mines believes further drilling is warranted to determine the extent of the deposit. A geologist and mining engineer of good repute believes the property has very good possibilities of having extensive reserves. A retired director of the U. S. Bureau of Mines office at Juneau, has expressed an opinion that some well directed drilling to the rear of these claims would stand a very good chance of finding some very substantial ore bodies. (See enclosure, ltr of S. H. Lorain, pp E-1.)

In view of the foregoing and inasmuch as the U. S. Bureau of Mines has recognized the incompleteness of their previous drilling program in 1948 (Report of Investigations, No. 4852, U.S.B.M.), they have programmed further work to re-appraise the exploration potential of Chichagof Island Gypsum deposits. The preliminary work commenced shortly after July 1, 1961, and is still in progress.

VI. Markets:

At present there are three cement companies interested in the purchase of bulk gypsum delivered to Seattle in an aggregate amount of

476,000 tons annually. An oil refinery to be built at Anchorage, desires to contract for 30,000 tons annually. Providing a reserve of 30,000,000 tons can be blocked out, another firm would then be interested in either purchase of the deposit or bulk shipments under a long term contract. A Puget Sound seaport has markets from two additional firms for 250,000 tons annually, if they can be assured of this amount for fifteen years. Two Japanese firms have enquired about the quality, as they are procuring their supply, for cement retarder, from Egypt, and it is not of the best grade for this industry. Another Japanese firm after assaying about 40 lbs of samples, desires 2,000 tons shipped to them in Japan so they can run it through their mill. Therefore, should adequate reserves be proven, markets are readily available.

The potential for construction of a calcining plant, a cement plant and a wall board factory is very favorable. The site, dependent on economic feasibility, could be situated at the mine, or Haines, Alaska, or in the Juneau area. With the increase in use of building and road construction, requiring cement or asphalt, gypsum is over more in demand.

VII. Uses of Gypsum:

There are a great many and varied uses for Gypsum. The more commonly known market form is ordinary blackboard chalk. It is a component part of many chemicals, one such being necessary in the process of wood to pulp. This substance was originally used in plastering walls. It has since become an ingredient in the manufacture of tooth-paste, crayons and buttons, in surgical casts and the grinding of telescopic lenses and in the brewing of beer! Gypsum is a most important ingredient of cement mix, added to control the time of set, and it is used extensively in the manufacture of plastics for a like reason. It is used almost exclusively in the manufacture of certain types of wall-board. To make wallboard better, gypsum was forged into paint manufacture. Experiments with plaster have led it into the ceramic and chinaware products field. Gypsum blocks can also be cheaply manufactured. A new machine has been developed and patented for the manufacture of inter-locking gypsum blocks. In building construction, they eliminate the use of studding, furring, lathing and heavy plaster, andthey make a fireproof and soundproof wall! It is possible that these blocks could be economically manufactured and marketed in this locale of southeastern Alaska.

VIII. Expansion of Industry:

In 1949, Kaiser Gypsum Company took over the plant of the Pacific Portland Cement Company at Redwood City, California. The plant capacity was increased to make 225,000 square feet of wallboard a day. Raw material for this plant and the plant at Long Beach, California, is quarried and crushed at San Marcos Island, in the Gulf of California, Mexico, and transported by a 10,000 ton capacity ship to the plants. The Long Beach plant manufactures a complete line of wallboard, plaster products and other gypsum specialties. Extensions were recently completed on their Long Beach plant which increased the capacity 60% and permitted an annual production of nearly 210 million square feet of 3/8 inch board. Kaiser has another plant at Antioch, California, reported to have an annual capacity of 180 million square feet of wallboard and 20,000 tons of plaster. In addition a new board plant was scheduled to be erected at Antioch to have an annual capacity of 94 million square feet of wallboard.

At Seattle, production began in 1954. The plant has a capacity of 100 million square feet of gypsum board a year and about 35,000 tons of plaster. The crude gypsum is unloaded from a ship and stored under an umbella-like roof of steel 175 feet in diameter. The potential annual capacity of all the Kaiser plants is in excess of 500 million square feet of wallboard and 100,000 tons of plaster!

Theraw gypsum used in all the plants is shipped from San Marcos Island, Mexico which is about 1200 water miles fromLong Beach.

Other gypsum companies have, and are, expanding their facilities also, such as U. S. Gypsum, National Gypsum and Bestwall. However, their programs are either in the eastern or central United States, and this expansion program of Kaiser Gypsum above mentioned, is only to show the growth of the industry on the West Coast of the United States. This firm is perhaps the largest in operation in this area. In this connection, it should be mentioned that the Flintkote Company of New Jersey recently purchased the large holdings of the Blue Diamond (Gypsum) Corporation in Nevada, which consists of about 4,000 acres where the gypsum occurs in four beds, ranging in thickness from 4 to 8 feet (too thin to be mined), to 12 to 20 feet in thickness, and both open quarry and underground mining is carried on, to a depth of 100 feet where anhydrite replaces the gypsum.

IX. Freight and Transportation:

A commercial tug and barge company at Seattle, long in the business of ocean towing, is very interested in hauling the ore from the mine to Puget Sound ports, using converted LST type hulls carrying approx-

imately 4,000 tons per barge. This firm has given a tentative quotation of $5.00 per ton andis subject to further negotiation depending on the quantity and frequency of shipments. Another reputable tug and barge company at Vancouver, Washington, is also interested in bidding for the hauling of bulk gypsum to Puget Sound or Columbia River area and has offered a quotation of $3.50 per ton from mine to Puget Sound ports.

The deposit is only 32 air miles southwest from Juneau on the scheduled air line route between Juneau and Sitka. It is 70 miles by water route and a small freight vessel makes a weekly scheduled trip past the property, carrying mail, freight and staples to various small communities in Chatham and Icy Straits areas.

The nature of the harbor andharbor bottom at the mine site is such that construction of terminal facilities would not be difficult.

X. Geology; Preliminary Report:

(The following is a report on the geology of the Chichagof Island Gypsum deposits made by Fred D. Gustafson for the Dant-Russell Company in September 1946, after spending six weeks in the area and based on his observations at the old Camel-Gypsum (now Lucky Gypsum Group) claims and the immediate area.)

The property investigated, lying in the converging paths of the warm westerly winds and the cold northerly winds is subject to southeasterly winds of varying intensity with an accompanying rainfall of up to one hundred sixty eight inches a year, but with comparatively little snow, the average annual snowfall ranging from six inches to several feet, with a general decline in amount shown over the past fifteen years. As shown in tables published by the U. S. Coast and Geodetic Survey, January and February are the only two months having an average temperature of less than 32°F., with 26°F., being the lowest monthly average.

The topography of the area is typical of an area in which there has been and still is strong mountain glaciation accompanied with a rapidly receding coastline. U-shaped valleys and hanging valleys are common and only in isolated sections do the original or pre-glaciation formations outcrop through the mantle of glacial till, which varies from coarse, poorly sorted, unconsolidated, conglomerate, to fine fossiliferous, silty till, which was washed out from the melting of the glaciers, to be deposited on what at that time were marine, off-shore benches; the coarse till, on the other hand, having been deposited by the glaciers as lateral terminal, or recessional morraines, or by the glacial waters in the near proximity of the glaciers. The difference between the deposition of the coarse and of the fine till is emphasized at this time inasmuch as

will later be shown, it is of significance in determining the possible extent of the Camel-Gypsum deposit from a commercial viewpoint. The many bays and inlets and straits, mark the invasion by the sea of the formerly elevated land, the former valleys now being submerged while the former mountains andhigh ridges or plateus remain as islands or as peninsulas. Drainage,in many places, has been hampered by irregular glacial morraines, but the general drainage pattern in the Cove area follows a southeasterly course with a series of roughly parallel streams. Dense spruce forests with a few scattered hemlock, cedar, and white ash further protect the watershed, and the dense undergrowth of blue-berry bushes, ferns and devil's clubs, is found to be within a few feet of the high tide mark. The combination of poor drainage and thick vegetation along with windfalls resulting from the occassionally strong southeasterly winds has resulted in the formation of numerous muskeg flats. These streams constitute the main drainage in the Cove area, although there is a fourth stream whose outlet is at the present camp site that apparently has a sufficient constant flow to serve as the source for the camp and the mining supply of water. Of the other three, Bear Creek, approximately one-half mile to the northeast of the camp, affords a possible source of hydro-electric power.

With regard to the regional geology, approximately thirteen thousand feet of limestone are exposed ranging in age from early Devonian to Permian. Late Permian or Post Permian granite intrusives are exposed three to four miles inland from the cove, forming mountains with elevations of up to three thousand feet. During the intrusion of the granites, the limestone along the contacts were subjected to an uplift and to consequent folds and faulting. Still more recent vulcanism has taken place on the form of intrusive stocks and sills, andesitic in nature, which being less durable than the granites and limestones, have weathered out, leaving pseudosinks and crevasses in the limestones. The great thickness of limestone exposed in the area is indicative of the folding and faulting that has taken place, however, most of the movement appears to be pre-Permian except for that associated with the granite intrusives. The base of the limestone mountain between Iyoukeen Cove and False Bay to the North shows strong drag folding, and possibly, is Devonian in age, whereas the overlying limestones conform more, in appearance, with the limestone exposed at the Cove, tentatively classified as Mississippian.

The Cove limestones are of two types: First, a gray massive limestone overlain by, Second, a calcerous or limestone breccia. Inasmuch as the contact between the limestone and the gypsum is no place exposed, a

strong uniformity or possibly disconformity between the two deposits can be inferred only. However, the proximity of the gypsum, tentatively classified as Permian, to the limestone is rather conclusive evidence of one or the other. Following the deposition of the gypsum there appears to have been a period of elevation during which the gypsum was at least partially stripped of its marine overburden with a later period of subsidence during which the gypsum exposed was again covered, this time with the marine laid, glacial till. Still another period of elevation then occured thus exposing the marine terrace which now constitutes the beach which, once again, is undergoing subsidence. Although the limestone and the breccia in the Camel-Gypsum area are void of detailed structure such as bedding that might be used in tracing the folding that has taken place, the relative exposures are indicative of normal folding, with at least two synclines in which gypsum occurs. This folding probably accompanied the initial period of elevation described above. Sufficient time elapsed before the following recession or subsidence to permit the anticlines to be eroded to the extent that a fairly uniform plain probably existed with only remnant limestone ridges. It is further felt that the initial period of elevation may have resulted from the intrusion of the granites and that the subsequent period of subsidence was the result of the shrinking or settling consequent to that vulcanism. The second period of elevation followed by the current period of subsidence appears to have been but a minor phase of diastrophism accompanying the intrusion, and in some places the extrusion, of the andesites, with but little deformation resulting to the already existing formations. The strike of the normal folding described above appears to be northwest and southeast, a controlling factor is the drainage pattern for the area. Gypsum on the Camel-Gypsum site is exposed only in the underground workings in three adits with the greatest distance between exposures being approximately two hundred and fifty feet. On the basis of topographic expression, the gypsum may be assumed to to extend at least one hundred feet further to the South of the most southerly adit in which gypsum actually is exposed, thus yeilding approximately three hundred and fifty feet of gypsum in a northerly direction. The depth and the westerly extension of the deposit are unknown, but with the knowledge that the limestones are elevated in the contact area of the granites to the West, and in the absence of any outcrops of limestone in the three quarters of a mile West of the Cove, it is felt that the gypsum has been subjected only to normal surface erosion as aforementioned, and not the heavy gouging action of glaciers which might have eroded most of the gypsum

except for the protected pockets had the glaciers extended sufficiently far eastward. The foregoing statement is based on the fact that in the underground workings the gypsum is unconformable overlain by only a few feet of medium sized glacial till which grades into fine, silty, fossiliferous, marine deposited, glacial till. Although at the time of this writing no tests have been run on the gypsum samples taken, it is felt that the tenure is above that actually required for a commercial deposit inasmuch as much of the gypsum exposed is of alabaster grade and inasmuch as it is known that half a million tons of high grade gypsum were mined at the nearby Pacific Coast Gypsum Mine, which stratigraphically, is in the same deposit.

Inasmuch as there are two underground exposures of gypsum approximately two hundred and fifty feet apart in a northerly direction, with a reasonable certaintly of another hundred feet to the south, and since, structurally, there is a possibility of an overall northerly extension of 1200 feet, the distance between the two limestone outcrops, inasmuch as there is approximately one hundred feet exposed in one of the adits with the possibility of three quarters of a mile extension in a westerly direction, and inasmuch as approximately twelve feet of gypsum exposed vertically, in the underground workings, it is felt, considering also, the hypothetical amount of erosion, that a diamond drilling exploratory program is warranted to determine actually, whether or not the deposit of gypsum is of commercial size and to determine whether or not the quality continues at a commercial grade.

(This concludes the geological report of Fred Gustafson.)

XI. <u>Property Development</u>:

The program for the exploration and development of the deposit is to consist of three phases.

The first phase is to be of an exploratory nature to determine the approximate thickness of the ore body. On satisfactory completion of the first phase, the second phase would then consist of the development and blocking out of the ore reserve with the goal of at least five million tons of commercial gypsum to be proved.

In order to block out the five million tons goal, the average depth of the deposit wouldhhave to be 15 feet over an area 3,960 feet long by 1,200 feet wide. Since gypsum in adit 3 is exposed at two levels, continuously to a depth of 56 feet, and since previous drilling shows gypsum at a depth of 44 feet at the face of the deposit, and since, structurally, it apparently extends for 1,200 feet across the face, it is felt strongly that the gypsum body continues, with possibly only super-

ficial gouges. Therefore, in lieu of the known estimated 2 1/2 million tons within this area, considering the 56 foot depth as a basis, there is good indication of an estimated 19 million tons of gypsum within this area.

Not knowing exactly what work is being done by the U. S. Bureau of Mines at this time, in exploring the potential of the of the Chichagof Island gypsum deposits, but conceiving that their work to the rear of the claims exposes gypsum, then the second phase would immediately be started and the third phase of placing the mine into operation would commence.

In the first phase, it is desired to diamond drill six holes with a total footage of 1,510 feet. The actual thickness of the ore body is to be determined by this drilling. A footage of 200 feet per hole is listed arbitrarily on the strength of reports - some verbal and others in the form of technical and professional papers concerning the occurence of gypsum at Iyoukeen Cove. The depth of ore at the old Pacific Coast Gypsum Mine was reported at 300 feet plus, an additional 100 feet of drilling per hole, or at such holes as might later be deemed adviseable, should be anticipated. In the event that the deposit of ore should be 200 feet thick, the additional footage would be applied to extra-lateral holes to thereby attain an equivalent tonnage. Approximate location of the proposed diamond drill holes with the estimated overburden at each hole is shown on the engineer's topographic map and does not accompany this report, due to size of the map. The occurence of gypsum as exposed in the present workings and the overburden are shown in a cross section map, see enclosure "Geological Sections, Camel-Gypsum" pp E-6. The diamond drilling of the second phase would furnish data necessary for determining the mining method that would be applied, and during this period, sites will be determined that definitely do not overlie any ore that might later be mined, such sites to be used for permanent installations, such as buildings, warehouses, crushers, etc. During this same period, soundings of the harbor will be taken and terminal facilities planned.

For the start of this work, the housing facilities at the property will be made liveable in a temporary manner to last for an approximate ten month period. It is planned to have a qualified geological engineer supervise the work and employ at least four men to commence these operations.

XII. Development Costs:

The costs schedules included as enclosures to this report

are estimates, however, they are based on verbal or written tentative quotations from persons or firms in each particular field. The estimates fro drilling were quoted by W. A. Peterson, diamond drill contractor, formerly of Juneau, and regarded by authorities as being knowledgeable in that field. The costs are corrected by the Wholesale Price Index to bring them to the 1959 level. The plant costs are a cursory estimate of the Meissner Engineering Corporation of Chicago. The costs of the Terminal Facilities, also cursory, was made by Cole and Paddock of Juneau.

A. First Phase:

1. Engineering supplies, Camp equipment, Transportation, Food, Fuel and Sundry supplies. Engineer & Laborers wages, Chemical analysis and Professional Services. . . . . .$ 18,980.30
2. Drilling costs: Overburden, Development and Marginal . . . . . .$ 16,031.77
3. Contingency (10% of 1 &2 above). . .$ 3,501.20

Total Cost, First Phase . . . . . $ 38,513.27

B. Second Phase:

1. Engineering Supplies, Camp equipment, Transportation, Food, Fuel and Sundry supplies, Engineer & Laborers wages, Chemical analysis and Professional Services. . . . . .$ 34,167.66
2. Drilling Costs: Overburden, Development and Marginal . . . . . .$ 41,770.33
3. Contingency (10% of 1 & 2 above) . .$ 7,593.79

Total Cost, Second Phase . . . . . $ 83,531.78

TOTAL COSTS: FIRST AND SECOND PHASES $122,045.05

C. Terminal Facilities:

The cost of the Terminal Facilities is included in the figure quoted for the planning and construction of the entire plant, however, it is mentioned here for information and comparative value only. It is planned to construct a creosoted wood pile pier approximately 800 feet in length, with an airplane float and small boat float, and also a "T" shaped wharf or else mooring dolphins at the outer end of the pier to facilitate barge or ship loadings by conveyor system for bulk shipping. The depth of water at the end of the pier will have to be deep enough to permit a 32 foot draft vessel to moor at low tide. Thecost of this type pier construction has been tentatively quoted at $35.00 per square foot $200,000.00

D. **Plant Construction:**

A very cursory estimate of the total plant construction, including planning and also the terminal facilities, although this latter may be contracted separately, was tentatively quoted after considerable discussion with Mr. Ben Svoboda of Meissner Engineers, Chicago.

Comparison was made with this location and that of a similar operation at Presque Isle, Michigan.

The quotation includes survey of the area for most suitable and practical location of buildings, bunkers, conveyors, crushers, in relation to mining and shipping operations, and includes equipment and machinery such as: loaders, crushers, feeders, etc. The buildings wouldinclude, at least, bunk-house, cook-house, machine shop, maintenance & tool shop, fuel storage, warehouse, office and other incidental shop space, water, fuel and electric and also sewerage disposal $5,000,000.00

E. Summary:

Property Development	$ 122,045.05
Terminal Facilities	$ 200,000.00
Plant Construction	$4,677,954.95
Total Cost	$5,000,000.00

F. Taxes and Depletion Allowance:

Mining operations in Alaska are not required to pay a license tax during the first 3 1/2 years of production and a new operation of this size, in value, may be exempted from income, license, excise andother taxes levied by the State for a period of 7 years, for the whole investment after operations are begun. The allowance for depletion included as an allowable deduction from gross income, would be 15%.

XIII. Maximum Cost of Mining and Cost Per Ton:

Based on the sale of 250,000 tons of bulk crude gypsum 93% pure, shipped from Iyoukeen Cove, Alaska to Seattle, Washington, during first year of production:

Sales income (no credit for by-products)	$ 3,000,000.00
Capital Cost *	$ 5,000,000.00
20% assumed as return on investment required, then net profit, after taxes	$ 1,060,000.00
Depletion Allowance = 15% of value of first marketable product	$ 450,000.00
Taxable Income ($1,060,000 - $450,000)	$ 610,000.00
Income Taxes ($610,000 x .56)=	$ 341,600.00
Profit before taxes	$ 1,401,600.00
Sales and Administrative Expenses, (2% of sales income).	$ 60,000.00
Interest on capital @ 6%.	$ 300,000.00
Gross Profit	$ 1,761,600.00
Maximum permissable costs of mining, milling, and beneficiation, per year	$ 2,238,400.00
Cost, per ton of product	$ 8.95

* Capital cost is based on cursory estimate and could conceivably be considerably less.

- - - - -

Freight Costs (Mine to Seattle)	$ 3.50 to $ 5.00 per ton.
Value (f.a.s. Seattle)	$12.00 T.
Value (f.o.b. Mine)	$ 7.00 T.
Estimated cost of mining	$ 2.50 to $ 4.00 T.

XIV. General Summary:

What Makes A Gypsum Deposit Economic?

A. The problems that must be considered in evaluating an economic gypsum deposit include:

(1) an available market;

(2) low mining costs;

(3) cheap transportation to point of use,

(4) good competitive quality, and;

(5) adequate tonnage.

B. Some dangers that must be considered are:

(1) interstratified impurities;

(2) presence of anhydrite;

(3) structural problems, and;

(4) removal of gypsum by subsurface solution.

C. In A, above, all conditions are favorable excepting item (5), which is unknown as yet, in excess of 2½ million tons, but which shows good possibility for extension of the deposit.

In B, above, all conditions are favorable excepting item (4) which cannot be determined except during the actual mining operations.

XV. Bibliography:

U. S. Bureau of Mines Report of Investigations No. 4852. (Diamond Drilling Camel-Gypsum Deposit, 1952)

U. S. Bureau of Mines Information Circular No. 7555. (Mining, Millin and Manufacturing Methods at the Blue Diamond Corp. Gypsum, Clark Co., Nevada)

U. S. Geological Survey Bulletin No. 1105, (Bibliography of Gypsum & Anydrite in U. S. etc)

U. S. Geological Survey Bulletin No. 989-B. (Gypsum Deposits Near Iyoukeen Cove, Alaska)

Gypsum, by L. P. Larson: reprint from U.S.B.M. Bull. 585 (Mineral Facts and Problems 1960 ed)

Engineering Report of Fred D. Gustafson, M.E. for the Dant-Russell Co. of St. Helens Oregon, 1946.

Historical Statistics of the U. S. Colonial Times to 1957, by U. S. Bureau of Census, 1960, supplemented,(for the Wholesale Price Index) to 1959 incl.

Mining Congress Journal, March 1957, "What Makes A Gypsum Deposit Economic, by J. F. Havard, V.P. Fiberboard Paper Products Corp.

XVI. Acknowledgements:

State of Alaska, Department of Mines & Minerals.

S. H. Logan, M.E., Regional Director (Ret.) U.S.B.M., Alaska.

Mr. Chas. M. Plarr, Gypsum Block Mfg., New York City.

Foss Launch & Tug Co., Tacoma, Washington.

Inland Navigation Co., Vancouver, Washington.

Oregon Portland Cement Assn., Portland, Oregon.

Meissner Engineering, Chicago.

Cole & Paddock, Marine Installations, Juneau.

Arthur D. Little Inc., Cambridge, Massachusetts, Economic Developmen

Richard A. Cooley, Juneau, Economic Consultant.

Jack W. Rheinhart, Geologist, Great Lakes Carbon Corp.

John Y. Cole, Jr., Geologist, Kaiser Gypsum Co.

W. G. Bradley, Consulting Engineer, Flintkote Corp.

John C. Hagen, Geologist, M. A. Hanna Corp.

ALL AGREEMENTS CONTINGENT UPON STRIKE FIRE OR OTHER CAUSES OF DELAY BEYOND OUR CONTROL SUBJECT TO CHANGE WITHOUT NOTICE

MR 114-6

MR File 114

Dant & Russell, Inc.

Pacific Coast Lumber and Shingles

Porter Building
Portland 4, Oregon

TELEGRAPHIC ADDRESS
"DANTRUS"
PORTLAND, OREGON
ALL CODES

DANT & RUSSELL, INC.
PERLITE DIVISION
FIR-TEX INSULATING BOARD CO.
ST. HELENS, OREGON

April 28, 1947

MR 114-10

Mr. Dave Housel
Hotel Ansonia
1625 Third Avenue, at Stewart St.
Seattle 1, Washington

Dear Dave:

Enclosed is a copy of our report to our Board of Directors on your gypsum property. The geological report written by Gus may be used on the outside. The report outlining the program and cost will undoubtedly vary, so that it will not be of much use to you.

In answering questions in your letter of the 24th, Mr. Gallagher of Columbia Metals Corp knows all the particulars of the option you gave us. I feel confident that any minor changes would not be objectionable.

I wish to take this opportunity to thank you for all past courtesies and at any time, we can be of help, do not hesitate to call upon us.

Yours very truly,

DANT & RUSSELL, INC., PERLITE DIVISION

Elko

Elko D. Zoradi

EDZ:ml

Enclosure

December 12, 1946

SEP 15 19

ESTIMATE OF DEVELOPMENT PROGRAM

CAMEL GYPSUM, ALASKA

B. D. STEWART
Director of Mines

The following report is to outline the program for the exploration and development of the Camel Gypsum deposit in Iyoukeen Cove, Alaska:

On August 30, 1946, an 18 months option for $60,000 was acquired from Mr. Dave Housel of Seattle, Washington, to buy 140 acres of gypsum-bearing ground.

Twenty thousand dollars ($20,000) in cash upon the exercise of said option, and the balance of $40,000 at the rate of ten cents (10¢) per ton for each ton of ore removed and shipped or transported from the premises, until such time as the said balance of $40,000 shall be paid; provided, however, that in all events minimum payments of not less than $4,000 per year shall be required to be made whether Dant & Russell, Inc. shall remove ore and minerals or not. Interest shall not accrue or become payable on the unpaid balance.

In addition, three claims containing 60 acres of land have been filed on by Dant & Russell, Inc. giving a total acreage of 200 acres.

The outlined program is to consist of three phases.

The first of these phases is to be of an exploratory nature to determine the approximate thickness of the ore deposit.

In the event of a satisfactory completion of the first phase, the second phase then would consist of the development and blocking out of the ore reserve with the goal of approximately 800,000 tons of commercial gypsum to be proved. In order to block out the 800,000-ton goal, the average depth of the gypsum would have to be 200 feet over an area 500 feet long and 200 feet wide.

The 18 months option is sufficiently long to carry out these two phases.

COST ESTIMATE OF DEVELOPMENT PROGRAM

CAMEL GYPSUM, ALASKA

The following report is to outline the program for the exploration and development of the Camel Gypsum deposit in Iyoukeen Cove, Alaska:

On August 30, 1946, an 18 months option for $60,000 was acquired from Mr. Dave Housel of Seattle, Washington, to buy 140 acres of gypsum-bearing ground.

Twenty thousand dollars ($20,000) in cash upon the exercise of said option, and the balance of $40,000 at the rate of ten cents (10¢) per ton for each ton of ore removed and shipped or transported from the premises, until such time as the said balance of $40,000 shall be paid; provided, however, that in all events minimum payments of not less than $4,000 per year shall be required to be made whether Dant & Russell, Inc. shall remove ore and minerals or not. Interest shall not accrue or become payable on the unpaid balance.

In addition, three claims containing 60 acres of land have been filed on by Dant & Russell, Inc. giving a total acreage of 200 acres.

The outlined program is to consist of three phases.

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The 18 months option is sufficiently long to carry out these two phases.

The third phase consists of placing the mine into production. The cost and duration of this phase cannot be estimated at this time as they are dependent entirely upon the results of the first two phases.

The present market price of gypsum is approximately $3.00 to $3.50 a ton, f.o.b. the mines. We have no advantage over any other gypsum operator in mining or handling costs. Our cost for these operations will duplicate his--approximately $3.00 per ton, f.o.b. the mine.

Our tremendous advantage over any existing competition is in freight costs. The nearest domestic deposits to the Northwest market are subject to a rail freight of 27¢ per 100 lbs. or $5.40 per ton.

We have been quoted, by the Inland Navigation Company of Vancouver, Washington, a tentative rate of $1.35 per ton from Iyoukeen Cove to the Portland area. This gives us a competitive advantage of approximately $4.00 per ton.

In the first phase, it is desired to diamond drill six (6) holes with a total footage of 1,510 feet. The actual thickness of the ore body is the unknown factor to be determined by the drilling; nevertheless, a footage of 200 feet per hole is listed arbitrarily on the strength of reports--some verbal and others in the form of technical and professional papers concerning the occurrence of gypsum at the Old Gypsum Mine, which is located 1½ miles to the southwest of the Camel Gypsum deposit.

The Old Gypsum Mine was operated by the Pacific Gypsum Company between 1905 and 1921, during which time approximately 500,000 tons of high-grade gypsum were recovered and shipped to Tacoma for the manufacture of wallboard and plaster.

Inasmuch as the depth of ore at the Old Gypsum Mine was reported at 300 feet plus, an additional 100 feet of drilling per hole, or at such holes as later might be deemed advisable, should be anticipated.

In the event that the deposit of ore should not be 200 feet thick, the additional footage would be applied to extra-lateral holes to thereby attain an equivalent or nearly equivalent tonnage.

Approximate location of the proposed diamond drill holes with the estimated amount of over-burden at each hole is shown on the topographic and plan map of Camel Gypsum which accompanies this report. (Exhibit "A")

The occurrence of gypsum as exposed in present workings and the over-burden are shown in a cross-section map also accompanying this report. (Exhibit "B")

It is proposed that the first four (4) holes of the drilling program be located at 100-foot centers. Should those holes develop sufficient quality and quantity of ore, the last two (2) holes will be drilled near the beach to determine the structure and nature of formations that will be of importance in determining the type of mining and in determining the safe proximity of mining operations to the water's edge.

Should the first phase be successful in developing a satisfactory thickness of the ore body, the second phase would be started.

The breakdown of estimated costs for the first and second phases is shown in Enclosure "C"; the first phase covering a period of ninety (90) days, and the second covering a period of seven (7) months.

The diamond drill holes, as tentatively spotted for the second phase, would develop a block of ore 500 feet in length and 200 feet in width, thickness as aforesaid to be determined by the drilling itself, and would furnish data necessary for determining the mining method that will be applied.

During the time the second phase drilling is being done, sites will be determined that definitely do not overlie any ore that might later

be mined, said sites to be used later for permanent installations, such as, buildings, warehouses, etc.

Also during this same period, soundings will be taken of the harbor and estimates obtained as to costs and location of docking facilities; also estimates will be compiled of the cost of putting the mine into production.

It is planned to send a crew of five (5) men from this area, which consists of a superintendent and four (4) men. These men will be on a monthly salary under a three-month contract.

The superintendent of the crew will be Mr. Fred D. Gustafson, who is presently employed with us in the capacity of geologist and engineer. Mr. Gustafson has been in the Dant & Russell, Inc. employ since the middle of May, 1946. We find him to be a thorough, conscientious worker with experience along the lines necessary to fulfill requirements needed to operate a camp away from the home office.

Enclosed is a report, made by Mr. Gustafson, on the gypsum property at Iyouheen Cove. (Exhibit "D"). Data for this report was gathered from an inspection tour of the property made by representatives of the Company in September, 1946.

Present housing facilities on the property will be made livable in a temporary manner to last throughout the ten (10) months of the development period.

E. D. Zoradi

ENCLOSURE "C"

Diamond Drill Hole No.	Estimated Overburden @ 5.90/ ft.	Development Drill Footage @ 4.85/ ft.	Marginal* Drill Footage @ 4.85/ ft.	
		FIRST PHASE		
1	65	200	100	
2	65	200	100	
3	80	200	100	
4	80	200	100	
5	10	200	100	
6	10	200	100	
First Phase Total	310	1200	600	
		SECOND PHASE		
7	45	200	100	
8	50	200	100	
9	85	200	100	
10	95	200	100	
11	115	200	100	
12	95	200	100	
13	95	200	100	
14	85	200	100	
15	105	200	100	
16	110	200	100	
17	85	200	100	
18	95	200	100	
19	65	200	100	
20	85	200	100	
Second Phase Total	1210	2800	1400	
First Phase	310	1200	600	
	1520	4000	2000	Marginal
			4000	Development
			1520	Overburden
GRAND TOTAL			7520	

* In the event that the deposit of ore is found to be 200 feet thick, an additional 100 feet of drilling per hole, or at such holes as might be deemed advisable, is anticipated.

1.	Engineering Supplies & Camp Equipment	$	5,000.00
2.	Transportation		1,250.00
3.	Food, Fuel, and Sundry Supplies		1,450.00
4.	Superintendent		1,050.00
5.	Junior Engineer		900.00
6.	Three Laborers		1,950.00
7.	Chemical Analyses		900.00
8.	Professional Services		--- --
		$	12,500.00
9.	Drilling Costs:*		
	Overburden 310' @ 5.90		1,829.00
	Development 1200' @ 4.85		5,820.00
	Marginal 600' @ 4.85		2,910.00
	Total Drilling Costs	$	10,559.00
	Other Costs		12,500.00
	TOTAL COST OF FIRST PHASE	$	23,059.00

* Based on figures quoted by W. A. Peterson, diamond-drill contractor from Juneau, Alaska, recommended by the Commissioner of Mines of the Territory of Alaska.

CAMP MAI EN CE AND MISCELLANEOUS NST CTION

1.	Engineering Supplies & Camp Equipment		$ 2,500.00
2.	Transportation		2,850.00
3.	Food, Fuel, and Sundry Supplies		3,360.00
4.	Superintendent		2,450.00
5.	Junior Engineer		2,100.00
6.	Three Laborers		4,550.00
7.	Chemical Analyses		2,100.00
8.	Professional Services		2,500.00
		$	22,410.00
9.	Drilling Costs:		
	Overburden 1210' @ 5.90		7,139.00
	Development 2800' @ 4.85		13,580.00
	Marginal 1400' @ 4.85		6,790.00
	Total Drilling Costs	$	27,509.00
	Other Costs		22,410.00
	TOTAL COST OF SECOND PHASE	$	49,919.00
	TOTAL COST OF FIRST PHASE	$	23,059.00
	TOTAL COST OF FIRST AND SECOND PHASES	$	72,978.00

PRELIMINARY REPORT ON THE GEOLOGY OF CAMEL GYPSUM, ALASKA

The following report is based on observations made at the Camel Gypsum group of claims and in the immediately surrounding area located in the northeastern section of Chichagof Island, Alaska, bordering Iyoukeen Cove, about two miles northeast of the gypsum mine formerly operated by the Pacific Gypsum Co. of Tacoma, Washington.

The property investigated, lying in the converging paths of the warm westerly trade winds and the cold northerly winds is subject to southeasterly winds of varying intensity with an accompanying rainfall of up to one hundred and sixty eight inches a year, but with comparatively little snow, the average annual snow fall ranging from six inches to several feet with a general decline in amount shown over the past fifteen years. As shown in tables published by the U. S. Coast and Geodetic Survey, January and February are the only two months having an average temperature of less than 32°, with 26° being the lowest monthly average.

The topography of the area is typical of an area in which there has been and still is strong mountain glaciation accompanied with a rapidly receding coast line. U-shaped valleys and hanging valleys are common and only in isolated sections do the original or pre-glaciation formations outcrop through the mantle of glacial till which varies from coarse, poorly sorted, unconsolidated, conglomerate to fine, fossiliferous, silty, till which was washed out from the glaciated areas by the glacial waters accompanying and resulting from the melting of the glaciers, to be deposited on what at that time were marine, or off-shore benches, the course till, on the other hand, having been deposited by the glaciers as lateral, ter-

minal, or recessional morraines or by the glacial waters in the near proximety of the glaciers. The difference between the deposition of the coarse and of the fine glacial till is emphasized at this time inasmuch as will later be shown it is of significance in determining the possible extent of the Camel Gypsum deposit from a commercial viewpoint. The many bays, inlets, and straits mark the invasion by the sea of the formerly elevated land, the former valleys now being submerged while the former mountains and high ridges or plateaus remain as islands or as peninsulas. Drainage, in many places, has been hampered by irregular glacial morraines, but the general drainage pattern in the Cove area follows a southeasterly course with a series of roughly parallel streams (see sketch "C"). Dense spruce forests with a few scattered hemlock, cedar, and white ash further protect the water shed, and the dense undergrowth of blue-berry bushes, ferns, and devil's clubs is found to within a few feet of the high tide mark. The combination of poor drainage and thick vegetation along with windfalls resulting from the occasionally strong southeasterly winds has resulted in the formation of numerous muskeg flats. Three streams constitute the main drainage in the Cove area, although there is a fourth stream whose outlet is at the present camp site that apparently has a sufficiently constant flow to serve as the source for the camp and mining supply of water. Of the other three, Bear Creek, approximately one half mile to the northeast of the Camel Gypsum camp, affords a possible source for hydro-electric power.

With regards to the regional geology, approximately thirteen thousand feet of limestone are exposed ranging in age from early Devonian to Permian. Late Permian or post Permian granite intrusives are exposed three to four miles inland from the Cove, forming mountains with elevations of up to

three thousand feet. During the intrusion of the granites, the limestones along the contact were subjected to an uplift and to consequent folds and faulting. Still more recent vulcanism has taken place on the form of intrusive stocks and sills, andesitic in nature, which being less durable than the granites and the limestones, have weathered out leaving pseudo-sinks and crevasses in the limestones. The great thickness of limestone exposed in the area is indicative of the folding and faulting that has taken place, however, most of the movement appears to be Pre-Permian except for that associated with the granite intrusives. The base of the limestone mountain between Iyoukeen Cove and False Bay to the north shows strong drag folding, and, possibly, is Devonian in age, whereas the overlying limestones conform more, in appearance, with the limestones exposed at the Cove, tentatively classified as Mississippian. The Cove limestones are of two types; first, a gray, massive limestone overlain; by, second, a calcareous or limestone breccia. Inasmuch as the contact between the limestone and the gypsum is no place exposed, a strong uncomformity or possibly discomformity between the two deposits can be inferred, only. However, the proximity of the gypsum, tentatively classified as Permian, to the limestone is rather conclusive evidence of one or the other. Following the deposition of the gypsum there appears to have been a period of elevation during which the gypsum was at least partially stripped of its marine overburden with a later period of subsidence during which the exposed gypsum was again covered, this time with the marine laid, glacial till. Still another period of elevation then occurred thus exposing the marine terrace which now constitutes the beach which, once again, is undergoing subsidence. Although the limestone and the breccia in the Camel Gypsum area are void of detailed structure

such as bedding that might be used in tracing the folding that has taken place, the relative exposures are indicative of normal folding, see the accompanying sketches, with at least two synclines in which the gypsum occurs. This folding probably accompanied the initial period of elevation described above. Sufficient time elapsed before the following recession or subsidence to permit the anticlines to be eroded to the extent that a fairly uniform plain probably existed with only remnant limestone ridges. It is further felt that the initial period of elevation may have resulted from the intrusion of the granites and that the subsequent period of subsidence was the result of the shrinking or settling consequent to that vulcanism. The second period of elevation followed by the current period of subsidence appears to have been but a minor phase of diastrophism accompanying the intrusion, and in some places the extrusion, of the andesites, with but little deformation resulting to the already existing formations. The strike of the normal folding described above appears to be northwest and southeast, a controlling factor in the drainage pattern for the area. Gypsum on the Camel Gypsum site is exposed only in the undergound workings in three adits with the greatest distance between exposures being approximately two hundred and fifty feet. On the basis of topographic expression, the gypsum may be assumed to extend at least one hundred feet further to the south of the most southerly adit in which gypsum actually is exposed, thus yielding approximately three hundred and fifty feet of gypsum in a northerly direction. The depth and the westerly extension of the deposit are unknown, but with the knowledge that the limestones are elevated in the contact area of the granites to the west, and in the absence of any outcrops of limestone in the three quarters of a mile west of the Cove, it

is felt that the gypsum might extend at least that far. It is felt that the gypsum has been subjected only to normal surface erosion as aforementioned, and not to the heavy gouging action of glaciers which might have eroded most of the gypsum except for protected pockets had the glaciers extended sufficiently far eastward. The foregoing statement is based on the fact that in the underground workings the gypsum is uncomformably overlain by only a few feet of medium sized glacial till which grades into fine, silty, fossiliferous, marine deposited, glacial till. Although at the time of this writing no tests have been run on the gypsum samples taken, it is felt that the tenure is above that actually required for a commercial deposit inasmuch as much of the gypsum exposed is of alabaster grade and inasmuch as it is known that half a million tons of high grade gypsum were mined at the nearby Pacific Gypsum Mine which, stratigraphically, is in the same deposit.

Inasmuch as there are two underground exposures of gypsum approximately two hundred and fifty feet apart in a northerly direction, with a reasonable certainty of an other hundred feet to the south, and since, structurally, there is a possibility of an over all northerly extension of 1200 feet, the distance between the two limestone outcrops shown in sketch "A", inasmuch as there is approximately one hundred feet of gypsum exposed in one of the adits with the possibility of a three quarters of a mile extension in a westerly direction, and inasmuch as approximately twelve feet of gypsum is exposed, vertically, in the underground workings, it is felt, considering, also, the hypothetical amount of erosion, that a diamond drilling, exploratory program is warranted to determine, actually, whether or not the deposit of gypsum is of commercial size and to determine whether or not the quality continues at a commercial grade.

Respectfully submitted,
Rred D. Gustafson
30 September 1946

COST ESTIMATE OF DEVELOPMENT PROGRAM

December 12, 1946

CAMEL GYPSUM, ALASKA

The following report is to outline the program for the exploration and development of the Camel Gypsum deposit in Iyoukeen Cove, Alaska:

On August 30, 1946, an 18 months option for $60,000 was acquired from Mr. Dave Housel of Seattle, Washington, to buy 140 acres of gypsum-bearing ground.

Twenty thousand dollars ($20,000) in cash upon the exercise of said option, and the balance of $40,000 at the rate of ten cents (10¢) per ton for each ton of ore removed and shipped or transported from the premises, until such time as the said balance of $40,000 shall be paid; provided, however, that in all events minimum payments of not less than $4,000 per year shall be required to be made whether Dant & Russell, Inc. shall remove ore and minerals or not. Interest shall not accrue or become payable on the unpaid balance.

In addition, three claims containing 60 acres of land have been filed on by Dant & Russell, Inc. giving a total acreage of 200 acres.

The outlined program is to consist of three phases.

The first of these phases is to be of an exploratory nature to determine the approximate thickness of the ore deposit.

In the event of a satisfactory completion of the first phase, the second phase then would consist of the development and blocking out of the ore reserve with the goal of approximately 800,000 tons of commercial gypsum to be proved. In order to block out the 800,000-ton goal, the average depth of the gypsum would have to be 200 feet over an area 500 feet long and 200 feet wide.

The 18 months option is sufficiently long to carry out these two phases.

The third phase consists of placing the mine into production. The cost and duration of this phase cannot be estimated at this time as they are dependent entirely upon the results of the first two phases.

The present market price of gypsum is approximately $3.00 to $3.50 a ton, f.o.b. the mines. We have no advantage over any other gypsum operator in mining or handling costs. Our cost for these operations will duplicate his--approximately $3.00 per ton, f.o.b. the mine.

Our tremendous advantage over any existing competition is in freight costs. The nearest domestic deposits to the Northwest market are subject to a rail freight of 27¢ per 100 lbs. or $5.40 per ton.

We have been quoted, by the Inland Navigation Company of Vancouver, Washington, a tentative rate of $1.35 per ton from Lyoukeen Cove to the Portland area. This gives us a competitive advantage of approximately $4.00 per ton.

In the first phase, it is desired to diamond drill six (6) holes with a total footage of 1,510 feet. The actual thickness of the ore body is the unknown factor to be determined by the drilling; nevertheless, a footage of 200 feet per hole is listed arbitrarily on the strength of reports--some verbal and others in the form of technical and professional papers concerning the occurrence of gypsum at the Old Gypsum Mine, which is located 1½ miles to the southwest of the Camel Gypsum deposit.

The Old Gypsum Mine was operated by the Pacific Gypsum Company between 1905 and 1921, during which time approximately 500,000 tons of high-grade gypsum were recovered and shipped to Tacoma for the manufacture of wallboard and plaster.

Inasmuch as thedepth of ore at the Old Gypsum Mine was reported at 300 feet plus, an additional 100 feet of drilling per hole, or at such holes as later might be deemed advisable, should be anticipated.

In the event that the deposit of ore should not be 200 feet thick, the additional footage would be applied to extra-lateral holes to thereby attain an equivalent or nearly equivalent tonnage.

Approximate location of the proposed diamond drill holes with the estimated amount of over-burden at each hole is shown on the topographic and plan map of Camel Gypsum which accompanies this report. (Exhibit "A")

The occurrence of gypsum as exposed in present workings and the over-burden are shown in a cross-section map also accompanying this report. (Exhibit "B")

It is proposed that the first four (4) holes of the drilling program be located at 100-foot centers. Should those holes develop sufficient quality and quantity of ore, the last two (2) holes will be drilled near the beach to determine the structure and nature of formations that will be of importance in determining the type of mining and in determining the safe proximity of mining operations to the water's edge.

Should the first phase be successful in developing a satisfactory thickness of the ore body, the second phase would be started.

The breakdown of estimated costs for the first and second phases is shown in Enclosure "C"; the first phase covering a period of ninety (90) days, and the second covering a period of seven (7) months.

The diamond drill holes, as tentatively spotted for the second phase, would develop a block of ore 500 feet in length and 200 feet in width, thickness as aforesaid to be determined by the drilling itself, and would furnish data necessary for determining the mining method that will be applied.

During the time the second phase drilling is being done, sites

will be determined that definitely do not overlie any ore that might later be mined, said sites to be used later for permanent installations, such as, buildings, warehouses, etc.

Also during this same period, soundings will be taken of the harbor and estimates obtained as to costs and location of docking facilities; also estimates will be compiled of the cost of putting the mine into production.

It is planned to send a crew of five (5) man from this area, which consists of a superintendent and four (4) men. These men will be on a monthly salary under a three-month contract.

The superintendent of the crew will be Mr. Fred D. Gustafson, who is presently employed with us in the capacity of geologist and engineer. Mr. Gustafson has been in the Dant & Russell, Inc. employ since the middle of May, 1946. We find him to be a thorough, conscientious worker with experience along the lines necessary to fulfill requirements needed to operate a camp away from the home office.

Enclosed is a report, made by Mr. Gustafson, on the gypsum property at Iyoukeen Cove. (Exhibit "D"). Data for this report was gathered from an inspection tour of the property made by representatives of the Company in September, 1946.

Present housing facilities on the property will be made livable in a temporary manner to last throughout the ten (10) months of the development period.

E. D. Zoradi

ENCLOSURE "C"

Diamond Drill Hole No.	Estimated Overburden @ 5.90/ ft.	Development Drill Footage @ 4.85/ ft.	Marginal* Drill Footage @ 4.85/ ft.
	FIRST PHASE		
1	65	200	100
2	65	200	100
3	80	200	100
4	80	200	100
5	10	200	100
6	10	200	100
First Phase Total	310	1200	600
	SECOND PHASE		
7	45	200	100
8	50	200	100
9	85	200	100
10	95	200	100
11	115	200	100
12	95	200	100
13	95	200	100
14	85	200	100
15	105	200	100
16	110	200	100
17	85	200	100
18	95	200	100
19	65	200	100
20	85	200	100
Second Phase Total	1210	2800	1400
First Phase	310	1200	600
	1520	4000	2000 Marginal
			4000 Development
			1520 Overburden
GRAND TOTAL			7520

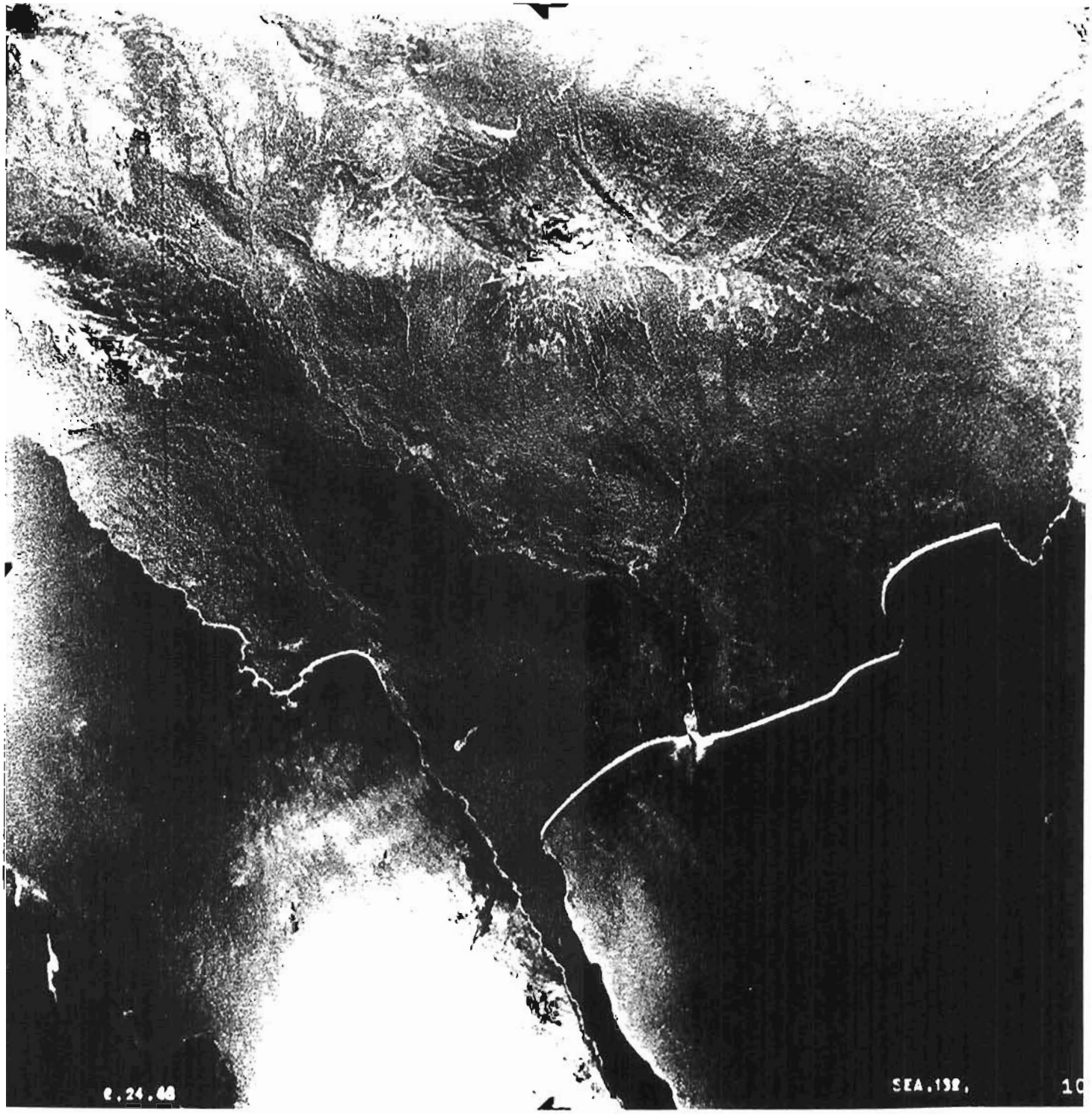
* In the event that the deposit of ore is found to be 200 feet thick, an additional 100 feet of drilling per hole, or at such holes as might be deemed advisable, is anticipated.

1.	Engineering Supplies & Camp Equipment	$ 5,000.00
2.	Transportation	1,250.00
3.	Food, Fuel, and Sundry Supplies	1,450.00
4.	Superintendent	1,050.00
5.	Junior Engineer	900.00
6.	Three Laborers	1,950.00
7.	Chemical Analyses	900.00
8.	Professional Services	-------
		$ 12,500.00
9.	Drilling Costs:*	
	Overburden 310' @ 5.90	1,829.00
	Development 1200' @ 4.85	5,820.00
	Marginal 600' @ 4.85	2,910.00
	Total Drilling Costs	$ 10,559.00
	Other Costs	12,500.00
	TOTAL COST OF FIRST PHASE	23,059.00

* Based on figures quoted by W. A. Peterson, diamond-drill contractor from Juneau, Alaska, recommended by the Commissioner of Mines of the Territory of Alaska.

CAMP MAINTENANCE AND MISCELLANEOUS CONSTRUCTION

1.	Engineering Supplies & Camp Equipment	$ 2,500.00
2.	Transportation	2,850.00
3.	Food, Fuel, and Sundry Supplies	3,360.00
4.	Superintendent	2,450.00
5.	Junior Engineer	2,100.00
6.	Three Laborers	4,550.00
7.	Chemical Analyses	2,100.00
8.	Professional Services	2,500.00
		$ 22,410.00
9.	Drilling Costs:	
	Overburden 1210' @ 5.90	7,139.00
	Development 2800' @ 4.85	13,580.00
	Marginal 1400' @ 4.85	6,790.00
	Total Drilling Costs	$ 27,509.00
	Other Costs	22,410.00
	TOTAL COST OF SECOND PHASE	$ 49,919.00
	TOTAL COST OF FIRST PHASE	$ 23,059.00
	TOTAL COST OF FIRST AND SECOND PHASES	$ 72,978.00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