

WESTERN WAR MINERALS

By PROF. HORACE J. FRASER

Dept. of Geology, California Institute of Technology

All of us are becoming increasingly conscious these days of the part many raw materials play in our daily lives. As the priorities system becomes more widespread, and more raw materials are totally withdrawn from civilian use and increasingly restricted in their military uses, there inevitably will be some very marked changes in both the technology, economics, and sources of our raw material supplies. Although the problem of supplying our essential needs is national, its effects will vary regionally. Its influence in the Southwest will be of particular interest because of the normal productivity of this area and the many rapid changes there taking place as a result of war activities. War stimulated industries leave their mark on peacetime industrial development. The tremendous expansion now going on around us will have many permanent effects, some of which are discussed in the following pages.

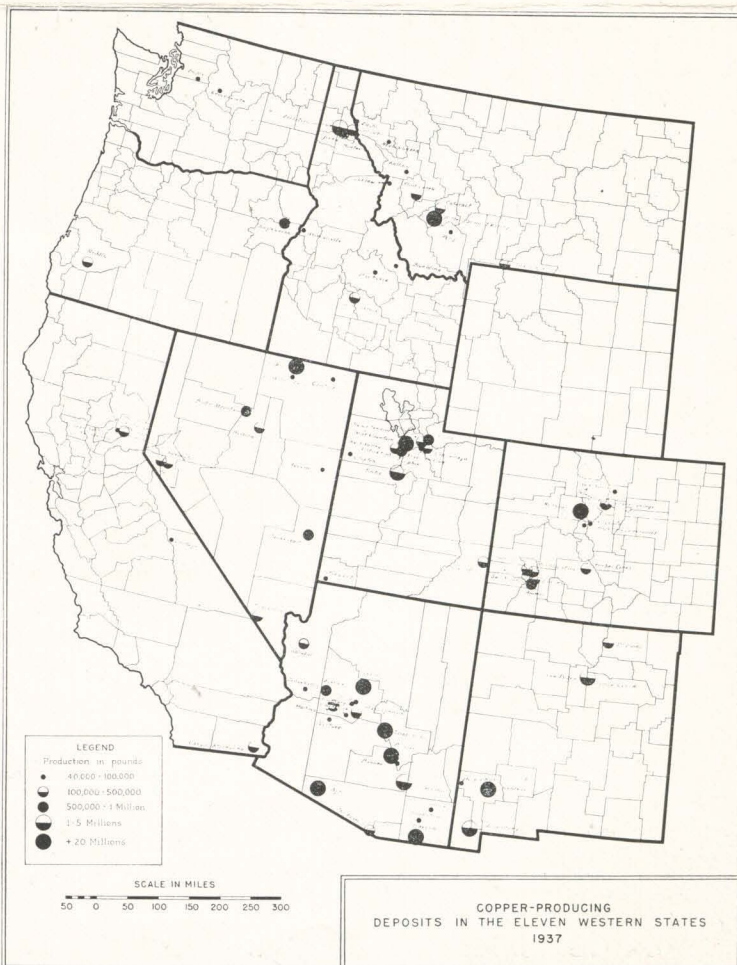
In 1940 the Army and Navy Munitions Board defined fourteen materials as strategic in the sense that dependence in war time must be placed in whole or in substantial part on sources outside the continental limits of the United States and strict conservation and distribution control measures must of necessity be enforced. This list of strategic materials included nine mineral products, namely antimony, chromium, manganese, mercury, mica, nickel, quartz crystals, tin and tungsten, together with five other materials: manila fiber, quinine, rubber, silk and cocoanut shell char. The same board also defined fifteen other materials as of critical importance, either because they had a lesser degree of essentiality or because they were obtainable in more adequate quantities from domestic sources. Some control over the use of critical materials was anticipated. These materials included five mineral products: aluminum, asbestos, iodine, platinum and vanadium, together with ten other materials: cork, graphite, hides, kapok, opium, optical glass, phenol, tanning materials, toluol and wood. Other mineral products regarded as essential to the national war effort and for which the supply was considered adequate if not abundant included bauxite, copper, 100-octane gasoline, industrial diamonds, iridium, zinc, fluorspar, lead, beryl, bismuth, cadmium, cobalt, rutile, zirconium, molybdenum and magnesium.

Since 1940 our foreign sources of supply and trade routes in many of these materials have been drastically altered. Great effort has been made to stimulate domestic production, particularly through governmental reconnaissance and wider dissemination of information concerning our resources, the drilling of many deposits of marginal or unknown value by the United States Bureau of Mines, and through Federal loans to finance development, exploration, and production of many mineral deposits. At the same time strenuous efforts have been made to control the price of various mineral products. For some metals, such as mercury, the price advance prior to its restriction reached a level such as to stimulate mining activity. In other cases the price restrictions were applied at levels such that additional production could be encouraged only through

a bonus paid for new metal. In general, metal prices have not advanced in any degree comparable to the increased demand while at the same time labor, supplies and all the other costs of mining have increased tremendously. Thus we are demanding that our mining industry increase production and utilize lower grade, higher cost ores, while its costs and taxes are steadily increasing and its profits disappearing. This has resulted in many very real problems for the producing mineral companies.

WESTERN RESOURCES

From both an economic and a geological standpoint the Rocky Mountain and Western States must be regarded as a unit in the domestic mining picture. This block includes the states of Montana, Wyoming, Colorado and New Mexico along the eastern edge, with the central states of Arizona, Nevada, Utah and Idaho, and the western states of Washington, Oregon and California. These eleven western states together constitute the major domestic source for many essential metals. Virtually all of our domestically produced chromite, molybdenum, tungsten, vanadium and uranium is obtained from these states; about 90 per cent of our copper, mercury and silver, 60 per cent of the gold, about 50 per cent of the lead,



and 35 per cent of the zinc. Only iron is conspicuously low among metals produced by the western states. This is due not to a shortage of iron ore, but to the unfavorable locations and unsatisfactory quality of coke and coal necessary in the reduction of iron ore to pig iron and steel.

The importance of the western states as a source of metals is not the result of accidental development or exploration, but is the inevitable consequence of the geological character of the area. Most metals are obtained from deposits found only in relatively close association with igneous rocks and then only where structural conditions have been favorable for the accumulation of ore. In the western states, large areas have been subjected to intensive intrusions of igneous rocks at successive geologic periods and usually under conditions favorable to the development of a variety of mineral deposits. Since mineralization, the prevailing conditions such as climate, vegetation, weathering and erosion, have aided the exposure of metalliferous deposits. As a result the western states not only contain numerous deposits with a very diverse metal content, but these deposits are so situated with respect to the earth's surface that they can be found and exploited. It is most probable that the western states will continue to be the main domestic source for many metals in the future.

CURRENT DEMAND FOR MINERALS

Let us briefly review the current situation with respect to strategic and critical mineral products insofar as it affects the western area. Production and consumption figures will be those of 1940, unless otherwise stated. Current figures although not generally available, do not materially change the 1940 picture for most metals.

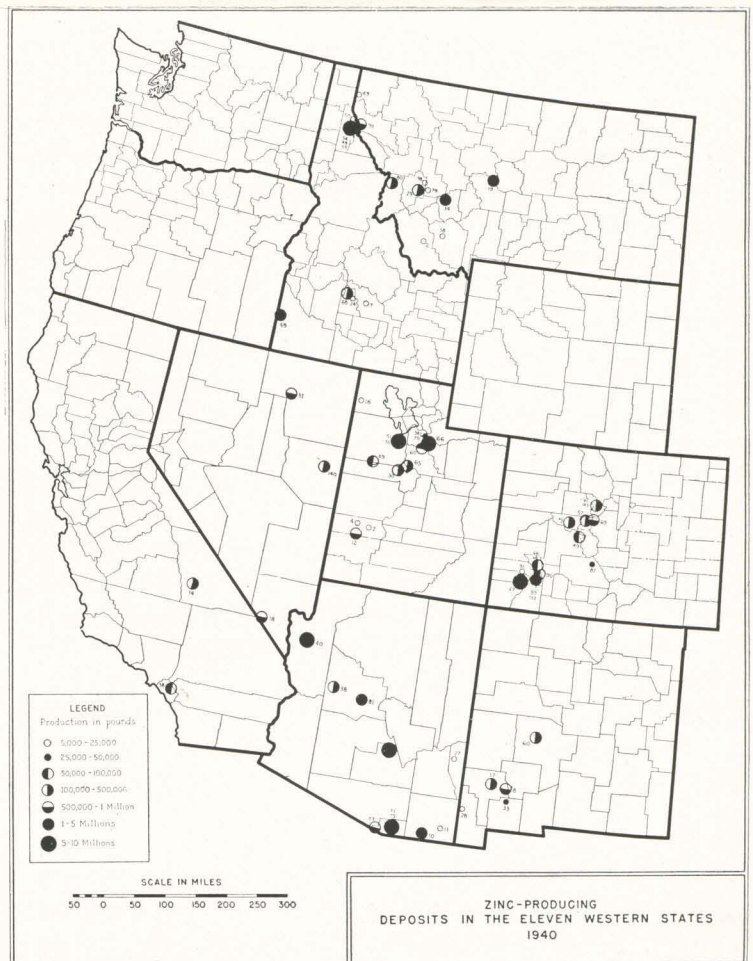
The demand for aluminum has expanded tremendously since 1940 because of its consumption in aircraft of all types. Aluminum is produced exclusively from the mineral bauxite which forms by long continued weathering under tropical conditions of aluminum rich rocks. Commercial bauxite deposits in the United States are restricted to Arkansas, Georgia, Alabama, Tennessee and Mississippi. It is most probable that materials other than bauxite will soon be used as a source of aluminum. Then, some of the alunite or aluminous clay deposits of the west may be utilized. However, until such time as these processes may be perfected, any aluminum produced in our western refineries will be obtained from bauxite either mined domestically or imported from abroad, mainly from the Guianas. The existence of these western plants, situated near cheap power but far from sources of bauxite will unquestionably greatly stimulate efforts to utilize other available new materials.

Antimony is widely used in peacetime as a hardener in lead. We normally consume about 18,000 tons of primary antimony and produce less than 1,000 tons. Its wartime uses include hardening of lead for bullets and shrapnel, use of the sulphide in priming caps of shells and explosives, and also in shells to produce a white cloud of smoke marking the position of the exploding shell. Normally our supplies of antimony are imported from China and Mexico. With loss of the Chinese supply we have been forced to expand domestic production from the many small antimony deposits scattered throughout the western states. Moreover, we at last are recovering sub-

stantial amounts of by-product antimony from lead-silver ores, particularly those in the vicinity of Kellogg, Idaho. Domestic deposits containing only antimony probably cannot continue producing under ordinary economic conditions, but the by-production may well continue after this emergency period is over.

For the 25-year period prior to 1938 we consumed on the average 49 per cent of the world's production of chromite, and produced less than 1 per cent of our needs. We used about 45 per cent of this chromite as a ferro alloy to produce hard, tough and chemically resistant steels. Another 40 per cent went into refractories, particularly for furnace linings and 15 per cent was used in various chemical fields, such as dyeing, tanning, and chrome plating. Our known chromite reserves are almost entirely in the west, particularly in California, Oregon and Montana. The California and Oregon deposits were extensively worked during the last war; the Montana deposits are a comparatively recent discovery and are now undergoing extensive development. The survival of a chromite industry after this war will depend entirely on price, since it has been clearly established that our domestic deposits cannot compete with foreign deposits under prices prevailing up to the present. The development of the Montana district and the attempt to work chromite beach sands in Oregon are current results of our need for chromite.

Iodine is essential in medicine and photography and we normally consume about 500 tons. Most iodine is recovered as a by-product from refining Chilean nitrate ore, but our domestic



production of iodine is normally obtained (by two companies in southern California) from treatment of natural brines. During periods of emergency additional supplies of iodine can be recovered from kelp and other sea-weed.

Manganese is consumed almost entirely by the steel industry, where about twelve pounds of manganese are used in the production of each ton of iron. This is added mainly as a manganese-iron alloy rich in manganese. Ores used in the preparation of this alloy must contain a high manganese and a low iron content. The ratio of manganese to iron should be 8 to 1 or better. Recently we have been consuming 900,000 tons or more of such manganese ore and have been producing from 25,000 to 40,000 tons of high grade ore. Our supplies normally have come about one quarter from the Gold Coast, one quarter from Soviet Russia, one sixth each from Cuba and India, and the balance from various other countries, of which Brazil is the most important. Now we are calling for increased domestic production. The western states contain practically all our known high grade domestic deposits. They also contain large reserves of low-grade deposits and others are found in Dakota, Minnesota and elsewhere. Most domestic high-grade deposits are small and the standard grade of ore can be obtained only by selective mining. In order to stimulate present production, the Metals Reserve Corporation has dropped its specifications from 48 to 30 per cent manganese. Our low grade reserves have not been previously mined because no facilities were available for concentrating low-grade ores, but several plants are now being built with Federal funds and we probably

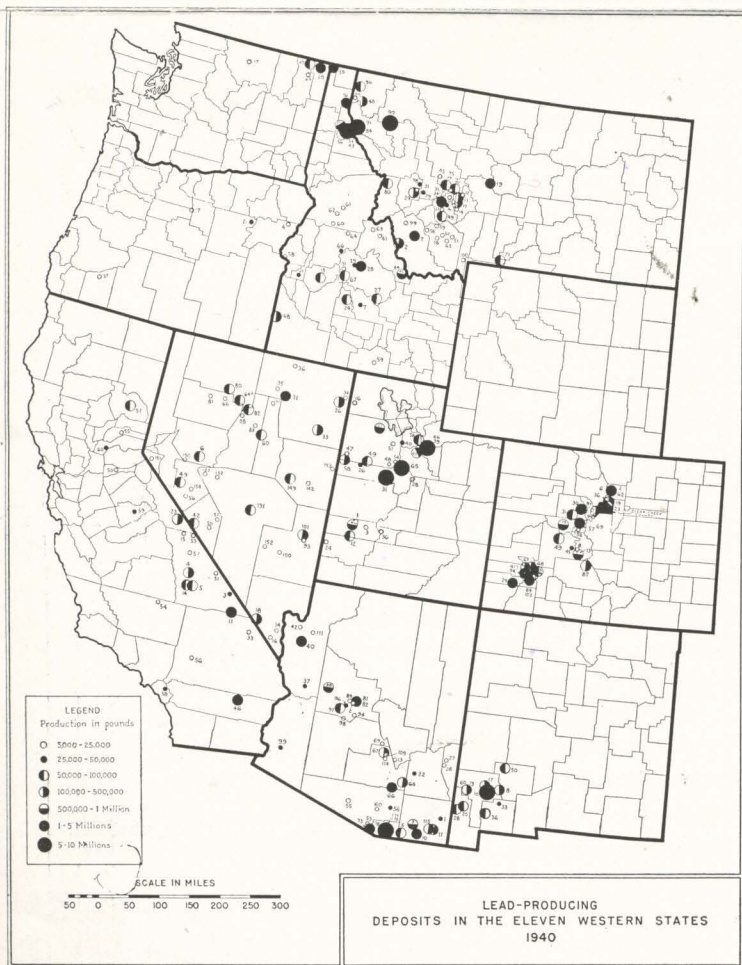
can anticipate continued production from this source after the war, particularly if the industry is protected by increased tariffs or a higher price.

During peace times mercury has a wide range of uses in the drug and chemical field. In war times mercury fulminate becomes of great importance as a detonator in all types of explosives. We normally consume about 750 tons of mercury a year and produce about three quarters of our needs. California, Nevada and Oregon have supplied most of our domestic production and imports have been obtained mainly from Spain and Italy. The rapid increase in the price of mercury from less than \$75 to more than \$190 a flask during the period 1939-1940 resulted in a tremendous expansion in mercury mining and a consequent increase in production. Old mines and old dumps have been reworked and many new prospects developed. The maintenance of our current production is problematical and will depend on further price increases since our reserves are being rapidly depleted. During the last year and a half or more we have produced substantially in excess of our needs and have been able to supply our neighbors with much needed mercury.

The demand in mica is mainly for large flakes and sheets of quality usable for condensers and insulators. We have adequate supplies of ground and ordinary mica but our better grades were imported mostly from Madagascar and India. During recent years our imports of all types of mica have ranged between 5,000 and 11,000 tons. Considerable success has been met in the eastern states in producing from high grade pegmatites and granite, but in the western states there is little if any increased production.

Our consumption of nickel has averaged somewhat more than 50,000 tons a year during recent years. The distribution of this nickel is about 60 per cent in ferrous alloys, non-ferrous alloys 28 per cent, electro-deposition 10 per cent, and the balance in miscellaneous uses. Nickel, like chromite, imparts strength and resistance, (particularly to acids), to steels in which it is alloyed. It finds a very wide range of use in many types of military and industrial equipment. Our supply of primary nickel is obtained almost entirely from the Sudbury district in Canada. We have a few small scattered deposits, but none appear to be of more than minor commercial importance.

Platinum is on the critical minerals list largely because of its utility as a chemical utensil and the part it plays in many chemical reactions. In 1939 we used about 100,000 ounces, of which roughly one half was consumed by jewelry, one fifth in the chemical industry, somewhat more than a tenth in the dental and electrical industries and the balance in various other fields. The entire domestic primary production of platinum minerals comes from Alaska, California, Oregon and Montana. Ordinarily California is the leading producer from gold washing operations, but during the last two or three years there has been a very large production from the Good News Bay district in Alaska, where platinum is found as a placer deposit. This production is now declining and probably the deposit will soon be worked out. We normally produce less than 10 per cent of our consumption of new platinum but quantities adequate



for all our needs are readily obtained as a by-product from nickel mining in Ontario.

The demand for radio-sending and detection devices of all types in this war has increased tremendously the need for quartz crystals, which are a vital part of many such units either as a frequency control, a crystal detector, or because of the piezoelectrical properties. Miscellaneous uses of strategic interest include range-finders, instruments measuring pressures or detonation in gun barrels or airplane engines, in depth sounding and direction finding apparatus, and for sundry precision instruments such as chronometers, seismographs, periscopes, gun-sights and polariscopes. These quartz crystals must be free from flaws of all types, twinning, impurities, intergrowths and fractures. Most of it occurs in igneous rocks or veins from which it only can be separated by explosives which fracture the quartz. Our supplies normally are obtained almost entirely from Brazil, where the quartz crystals are found in clays resulting from the long-continued weathering of igneous rocks. By this process the matrix around the quartz is decomposed and the quartz liberated.

Our imports increased from about 10 tons in 1936 to 63 tons in 1940. There are one or two deposits in California where optical quartz can be mined. Weathering conditions throughout the west however, have not favored the liberation of optical quartz from our existing deposits.

Tin finds its greatest use in the ever-present tin can, which consumes about 40 per cent of our normal consumption. Another 20 per cent goes into solder and the balance of the tin consumed is spread through a very wide range of uses, of which babbitt, bronze, collapsible tubes, tinning, chemicals, type metals, tin oxide, and so on, are all important uses. We normally consume about 75,000 tons of tin a year, or equivalent to somewhat more than 40 per cent of the world's production. Our normal production of tin from primary sources is 25 tons, or less, a year. There are no known tin deposits of economic importance within the United States.

Tungsten is one of the ferroalloy materials which, although we consume only about 7,000 tons a year, is absolutely vital to both peace and war activity. Tungsten is added to ferroalloys to improve their resistance to heat, fatigue, abrasion and corrosion; the largest and most important use is in the manufacture of high-speed tool steels which retain their hardness at red heat. Self-hardening steels are another important use and the recent development of tungsten carbide and powdered tungsten in cutting tools makes them a potential substitute in many uses for industrial diamonds. Although the use of tungsten filaments in electric lights is very widespread, it accounts for only about 1½ per cent of the annual consumption of tungsten. Our domestic tungsten production, all from the western States, has increased from about 2,500 tons in 1939 to over 5,000 tons in 1940, and the rate of increase is still accelerating. The exploration of scheelite deposits has been greatly aided by the fluorescent lamp. With the recent development of two or three new and potentially large western producers, we may become self-sufficient in tungsten and continue so after the war.

Vanadium is another important ferro alloy metal of which we normally produce less than half of our consumption. In

1939 the apparent consumption of vanadium was somewhat over 2,000 tons, mainly in steel alloys of special types. In part, vanadium is used in high-speed tool steels, in carbon vanadium steel and similar special steels which are noted for their hardness, tensile strength and unusual toughness. Our domestic production is all obtained from Colorado and Utah and our imports come mainly from Peru.

Among the metals not on the strategic or critical list but which at the present time appear of great importance in the war activity and which are becoming increasingly scarce, one should mention copper, zinc, lead and magnesium. In all of these it is not so much a case of a shortage in our raw materials but a bottleneck in our productive capacity coupled with the fact that our proposed uses are far in excess of anything within our past experience. The accompanying figures show the distribution of the western production of the first three of these vital metals. The production there portrayed accounts for about 90 per cent of our domestic copper, 50 per cent of our lead, and 35 per cent of our zinc.

FUTURE TRENDS

During the past few years exploration and development of our mineral deposits has been more active than at any period since the last war and possibly even more active than then. Despite this activity, aided by recent technological improvements, it must be realized that the discoveries of new deposits have been disappointingly few in number and in importance. Practically all of our production, both from current producers and from new deposits now being brought to production, is from deposits known during the last war.

It must be realized that the surface of our western states has been rather thoroughly examined during the past fifty years of mining activity. There are very few districts in which a mineralized deposit of substantial size could be located and which had not been examined by one or more competent mining men. We no longer have great geologically unexplored and unexploited areas. Future discoveries will mostly be made either as extensions of known ore bodies or will be discovered by use of sub-surface methods, either geological or geophysical.

Our consumption of metals is on such a large scale that discoveries of new reserves must be made frequently and ore bodies of substantial size must be developed if we are going to maintain our present rate of consumption. It is evident that we have not done this during the past 25 years and during this emergency every effort is being made to stimulate production at the expense of exploration. Our rich deposits are rapidly being depleted and only the low grade ores left to compete with foreign producers. We must look elsewhere for an increasing proportion of our mineral supplies and also expect to pay more for those produced domestically. The effects of this trend will become increasingly apparent and important to the Southwest when the present emergency is past.

Maps reproduced from "Metalliferous Deposits of the Eleven Western States", written by Horace J. Fraser, and published by the Industrial West Foundation.

10-1964

Silica Specifications

Carborundum Company

Silica	99.5% 99.6% (99.35% min.)
Al ₂ O ₃	<.10
CaO	<.20
Fe ₂ O ₃	<.20
Size	-2" + 1/8" washed
Tonnage	2000 T/mo.
Price: Bristol ..	\$9/ton Portland
Hemphill..	\$8.80/ton

WELCOME TEACHERS!
 VANCOUVER COMMUNITY RESOURCES DAY
 OCTOBER 16, 1957

Some facts about the Vancouver Plant of The Carborundum Company.

	<u>1957 (est.)</u>	<u>1958 (est.)</u>
Plant Investment	\$7,500,000	\$8,500,000
No. Employees	135	158
Annual Payroll	\$ 700,000	\$ 825,000
Investment per Employee - Average	\$55,000	

Raw Material Usage

Silica	48,000 tons	60,000 tons
Carbon	32,000 "	39,000 "
Sawdust	11,000 "	13,000 "
Salt	400 "	600 "
Power	23,000 KW	30,000 KW
Raw Material & Power Costs	\$1,250,000	\$1,625,000
Silicon Carbide Products Produced	20,000 tons	26,000 tons

Employee Benefits

Company Pension Plan, Life Insurance, Hospital and Surgical Insurance, Sick Benefit Insurance, Vacation Plan, Safety Program. Employees represented by The Carborundum Division of the Aluminum Trades Council, A. F. of L.

Other Facts about The Carborundum Company -
 Main Offices - Niagara Falls, N. Y.

1956 Sales \$104,000,000
 1957 Sales (est.) \$111,000,000
 Number of Plants 31

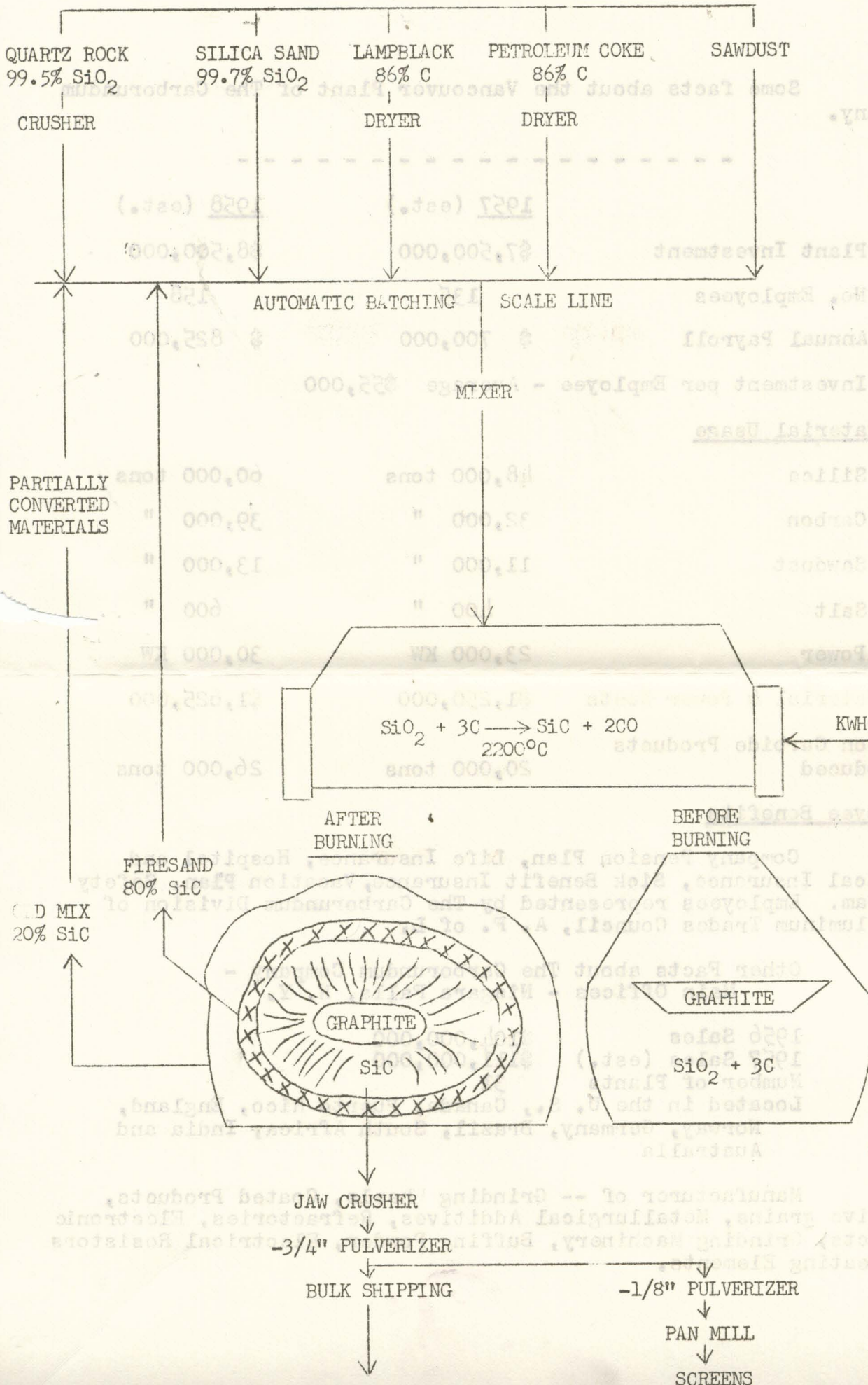
Located in the U. S., Canada, Puerto Rico, England, Norway, Germany, Brazil, South Africa, India and Australia

Manufacturer of -- Grinding Wheels, Coated Products, Abrasive grains, Metallurgical Additives, Refractories, Electronic Products, Grinding Machinery, Buffing Powder, Electrical Resistors and Heating Elements.

VANCOUVER, WASHINGTON

GENERAL FLOW DIAGRAM
SILICON CARBIDE FURNACE PLANT

RAW MATERIALS





UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Branch of Mining Operations
420 Empire Building
231 E. 4th South
Salt Lake City, Utah 84111

October 31, 1963

Mr. Hollis M. Dole, Director
Department of Geology and Mineral Industries
Portland, Oregon

Dear Mr. Dole:

Enclosed is a list of the sodium permits, in good standing, in your State of Oregon. As you can see, we do not have many such permits in force. This list is being sent you on the request of Mr. Russell Wayland, Regional Geologist, U. S. G. S., Los Angeles, California.

If, at any time in the future you would like information on current permits or leases in Oregon I would gladly send you the list. This could be done on a six-month or yearly basis, and on your request.

This office appreciates the opportunity of furnishing such information and wishes you to feel free to call upon us in the future.

Sincerely,

Ernest Blessing
Regional Mining Supervisor

Enclosure

cc:

Russell Wayland

RECEIVED
NOV 4 1963
STATE DEPT. OF GEOLOGY
& MINERAL INDS.

SODIUM PERMITS

Oregon 013099
Brian G. Booth
2656 S. W. Ravensview Drive
Portland 1, Oregon

T. 35 S., R. 34 E., W.M., Oregon
sec. 14, all;
sec. 22, all;

containing 1,280 acres

Oregon 013268
Edward L. Epstein
295 Third Street
Lake Oswego, Oregon

T. 34 S., R. 34 E., W.M., Oregon
sec. 24, all;
sec. 25, all;
sec. 26, all;
sec. 27, $E\frac{1}{2}$, $E\frac{1}{2}NW\frac{1}{4}$, $SW\frac{1}{4}NW\frac{1}{4}$, $SW\frac{1}{4}$,

containing 2,520 acres

Oregon 013100
A. Keith Martin
16758 Graef Circle
Lake Oswego, Oregon

T. 35 S., R. 34 E., W.M., Oregon
sec. 1, lots 1,2,3,4, $S\frac{1}{2}NE\frac{1}{4}$, $S\frac{1}{2}NW\frac{1}{4}$,
 $SW\frac{1}{4}$, $SE\frac{1}{4}$;
sec. 2, lots 1,2,3,4, $S\frac{1}{2}NE\frac{1}{4}$, $S\frac{1}{2}NW\frac{1}{4}$,
 $SW\frac{1}{4}$, $SE\frac{1}{4}$;
sec. 10, $NE\frac{1}{4}$;
sec. 11, $N\frac{1}{2}$, $N\frac{1}{2}SE\frac{1}{4}$;
sec. 12, all,

containing 2,521.96 acres

Oregon 013266
William M. McAllister
7453 S. E. 31st Avenue
Portland 2, Oregon

T. 35 S., R. 34 E., W.M., Oregon,
sec. 3, lots 1,2,3,4, $S\frac{1}{2}NW\frac{1}{4}$, $S\frac{1}{2}$;
sec. 4, lots 1,2,3, $S\frac{1}{2}NW\frac{1}{4}$, $S\frac{1}{2}$;
sec. 9, $N\frac{1}{2}NE\frac{1}{4}$;
sec. 10, $NW\frac{1}{4}$, $SW\frac{1}{4}$, $SE\frac{1}{4}$,

containing 1,639.02 acres

Oregon 013267
William M. McAllister
7453 S. E. 31st Avenue
Portland 2, Oregon

T. 34 S., R. 34 E., S.M., Oregon
sec. 33, $E\frac{1}{2}NE\frac{1}{4}$, $E\frac{1}{2}SW\frac{1}{4}$, $NW\frac{1}{4}SW\frac{1}{4}$, $SE\frac{1}{4}$;
sec. 34, all;
sec. 35, all,

containing 1,640 acres

October 31, 1963

September 8, 1941

Mr. Clarence Anderson
Jordan Valley, Oregon

Dear Mr. Anderson:

I am enclosing a copy of my report, made in April 1939,
of your nitrate deposit. You are free to use this as
you see fit.

Very sincerely yours,

JEA:vm
encl.

John Elliot Allen
Geologist

STATE GOVERNING BOARD

W. H. STRAYER, CHAIRMAN, BAKER
ALBERT BURCH MEDFORD
E. B. MACNAUGHTON . PORTLAND

EARL K. NIXON
DIRECTOR

F. W. LIBBEY
MINING ENGINEER

JOHN ELIOT ALLEN
GEOLOGIST

LESLIE L. MOTZ
METALLURGICAL CHEMIST



STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

702 WOODLARK BUILDING
PORTLAND, OREGON
September 2, 1941

STATE ASSAY LABORATORIES

400 E. 1 ST., GRANTS PASS

RAY C. TREASHER
FIELD GEOLOGIST

ALBERT A. LEWIS
ASSAYER

2102 COURT ST., BAKER

HUGH K. LANCASTER
FIELD ENGINEER

WILLIAM T. BURNS
ASSAYER

RECEIVED
SEP 3 1941

STATE DEPT OF GEOLOGY
& MINERAL INDS.

Mr. John Eliot Allen, Geologist
702 Woodlark Building
Portland, Oregon

Dear John:

Attached is a letter which was received by this office today addressed to you relating to some work which you did on the nitrate deposits near Jordan Valley. I am sending it to you because I do not have the information available here to answer it.

Sincerely yours,

A handwritten signature in blue ink that reads "Les".

Les Richards,
Assayer

Enclosure

RECEIVED

SEP. 2 1941
STATE ASSAY LABORATORY
BAKER, OREGON

RECEIVED
SEP 3 1941

STATE DEPT OF GEOLOGY
& MINERAL INDS.

Jordan Valley, Ore.
Aug. 28, 1941

John Elloit Allen
Baker, Oregon
Dear Sir,

you were out here about three years ago to look at a sodium nitrate deposit and made a report on it. Do you have this report on file? If you do, would you please send it either to Mr. B. W. Dyer, District Mining Supervisor, Salt Lake City ^{on myself}? We don't seem to be able to convince anyone that there is such tonnage. Thanking you. I remain,

yours truly,
Clarence Anderson

June 24, 1939

Mr. C. C. Anderson
Jordan Valley, Oregon

Dear Mr. Anderson:

Enclosed herewith is copy of the report on your proposition made by our field engineer, Mr. John Allen. I had an opportunity to discuss the situation with Allen while he was in this office sometime ago and came to the conclusion that there is just a long-range chance of your being able to make something out of the nitrate by the method suggested in Allen's report. Transportation to the railroad will be your greatest handicap. It might be well for you to read this report over carefully and make inquiries of some of the chemical or fertilizer companies and see if they would be interested.

With best wishes, I am

Respectfully yours,

EAN:vm
encl.

Director

REPORT

NITRATE GROUP

Malheur District

Malheur County

Owners: C. C. Anderson, 4 claims; and S. S. Scoggin, 4 claims, both of Jordan Valley, Oregon.

Location: Sec. 33, T. 28 S., R. 41 E., below the junction of Bogus Creek and the Owyhee River on both sides of the river.

Miscellaneous: This is located 20 miles from the highway near Arock, Oregon, and about 30 miles by air northwest to the railroad at Riverside. It is in sagebrush country with no trees. The river is fairly large, with a good all-year-round flow. The river canyon exposes a section consisting of over 100 feet of a gray to whitish well-banded rhyolite with perlitic and lithophysae structures which give it a very open texture. The dense well-banded rhyolite looks in places like coarse-banded sandstone. The perlitic material looks in places like a conglomerate. The numerous open cavities are lined or filled with soluble nitrates or other salts and secondary accumulations of this material appear at the head of the talus slopes around the cliffs. These salts apparently occur throughout the entire flow which forms the walls of the canyon for nearly a mile and are secondarily concentrated in several pocket areas and cavities. Above the rhyolite there is a columnar basalt flow from 20 to 50 feet in thickness. Overlying this is several hundred feet of yellow tuff. A mere canyon flow of lava at one time filled the gorge to a height of at least 50 feet, but now this has been nearly all eroded away leaving occasional bench remnants.

Analysis by George W. Gleeson of Oregon State College was as follows:

	<u>#1</u>	<u>#2</u>
% Soluble water 100° C.	7.07	59.37
% Insoluble	<u>92.93</u>	<u>40.63</u>
	100.00	100.00
Analysis of soluble portion:		
NaSO ₄	7.09	0.58
NaCl	17.30	0.50
NaCO ₃	Trace	Trace
NaNO ₃	<u>75.61</u>	<u>98.92</u>
	100.00	100.00

Conclusions: Although the material is too hard to mill and leach in the extraction of the nitrate salts, another possibility is suggested by drilling several drill holes from above into the deposit and pumping water into these holes--the entire deposit might be leached in place, the liquor being carried off in tunnels from below. It is possible that the cost factors in this way might be so reduced as to compete with more favorably located deposits.

STATE DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
By: John Eliot Allen, Field Geologist.

5/14/39.

(diagram)

RECEIVED
JUN 22 1939

STATE DEPT OF GEOLOGY
& MINERAL INDS.

Jordan Valley, Ore.
June 21, 1939.

State Department of Geology &
Mineral Industries
329 S. W. Oak St.
Portland, Ore.

Dear Sir:-

Some time ago your field
man was out and took
samples of our Sodium
nitrate deposit.

I should like to have the
states report on the deposit.

Thanking you kindly
Very truly yours,
C. E. Anderson

~~AMS~~
think you have copy of
John's Report on
this.

May 1, 1939

Mr. C. C. Anderson
Jordan Valley, Oregon

Dear Mr. Anderson:

Thank you for your letter of April 25th in regard to the nitrate deposit. I am sending your letter with a copy of this letter to our field geologist, John Elliot Allen, c/o Baker State Assay Laboratory, asking that he visit you when time permits. Unfortunately we are extremely occupied and getting ready to carry out our State Geological Survey work this summer, and I cannot promise when Mr. Allen will be able to visit you.

The deposit is of interest to us, and we shall probably help you do something with it if it is not too hard to get at and if it is large enough to interest large corporation.

The duPont interests at Wilmington, Delaware, might possibly be interested, or the Chipman Chemical Company (Pennsylvania Salt Company), who are considering an installation of a sodium chlorate plant at Bonneville, might also be interested. I cannot at the moment give you the name of the salt company at San Francisco that is quite active but can probably get it for you. I am rather of the opinion that you would do well to let our geologist look into the prospect because with first-hand information we will be in a better position to help you.

We are, of course, primarily interested in seeing the development of the mineral properties of the State and will do everything possible to that end. This deposit might supply material for a Bonneville industry, so we would like to follow it up.

Respectfully yours,

EKN:va

Director

cc: Mr. John Elliot Allen

C O P Y

Jordan Valley, Oregon

April 25, 1939

State Department of Geology
and Mineral Industries
Portland, Oregon

Dear Sir:

In reply to your letter of inquiry of the Sodium Nitrate deposite.

This deposite is an intrusion rock deposite, it has no overburden. The deposite is about two hundred and fifty feet thick in sight about twelve hundred feet wide, and around six thousand feet long.

The Owyhee River cuts through this deposite, so water for milling operations is most convenient.

I am sending to Doctor Gleeson average samples of the entire deposite for his extimate of the value.

Your advise as to what companies interested in such a deposite would be greatly appreciated. I have other samples if you care to see them. I would send them to you.

I wish to thank you very kindly for your courtesy.

Very truly yours,

(Signed)

C. C. Anderson

COPY

April 28, 1939

Mr. C. C. Anderson
Jordan Valley, Oregon

Dear Mr. Anderson:

I have received your third sample of nitrate and your letter describing the deposit. An analysis was made for the soluble material, the percentage by weight being 11.99%. No analyses were made for soluble salts such as carbonates, sulphates, or chlorides, it being assumed that the previous values would be representative or on such a basis, the last sample would show 9.05% nitrate, somewhat more than sample No. 1 of the last report.

Personally, I believe you did not obtain an average sample or else the material is decidedly segregated, since practically all of the nitrate was in one single piece, the remainder being entirely insoluble except for trace values. A small variation in weight of the one particular piece would influence the analysis greatly; consequently, I would not place too much faith in the above figures unless you are certain of your sampling procedure.

As regards the deposit, the presence of nitrate in the Owyhee district has been known for many years. Needless to say, economy has never justified treatment for recovery. The recovery process itself would not be involved, but upon the supposition that the above percentage is representative, you would have to handle 10 tons of the material to obtain 1 ton of nitrate at 100% recovery. After treatment, the price F.O.B. plant in bags would not exceed \$25 per ton for a product at least 90% pure, which on a theoretical basis would amount to a gross return of \$2.50 per ton. It is doubted that the material could be processed for this figure and yield any substantial profit.

I know of no companies interested in impure nitrate deposits at the present time, since the market price is so low (due to competition between synthetic nitrate and Chilean nitrate). I am certain that no company would be interested unless full particulars as to nature and extent of the deposit were available. I do

Mr. C. C. Anderson

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April 28, 1939

not wish to appear pessimistic, but my advice would be to wait until someone from the Department of Geology and Mineral Industries or other persons familiar with blocking out mineral bodies was able to visit your property.

Under separate cover, I am sending a sample of the once reclaimed salt and the detritus from which it was extracted.

Very truly yours,

G. W. Gleeson

George W. Gleeson,
Professor of
Chemical Engineering

GWG:jn

April 21st 1939

Mr. C. C. Anderson,
Jordan Valley,
Oregon.

Dear Mr. Anderson:

I note, from copy of letter from Dr. Gleeson to you, that the material you sent in is a satisfactory grade of sodium nitrate. This is quite interesting. Both you and I must thank Dr. Gleeson for his kindness in making these determinations.

I suggest that you send us at your convenience a brief report of the occurrence of this mineral. We would like to know how thick it is, how much ground it covers, whether it is at surface or covered by over-burden, etc.

Thanking you, I am,

Respectfully yours,

Director

EKN:fas

CC: Dr. G. W. Gleeson, Corvallis

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APR 19 1939

COPY

STATE DEPT OF GEOLOGY
& MINERAL INDS.

April 17, 1939

Mr. C. C. Anderson
Jordan Valley, Oregon

Dear Mr. Anderson:

Through the State Department of Geology and Mineral Industries I am transmitting information regarding the analysis of the two samples of sodium nitrate which were relayed to this department. Sample No. 1 is designated as the material in the more uniform, finely divided state and Sample No. 2 as the more coarse, somewhat crystalline material. No attempt was made to analyze the water insoluble portion of the sample other than to note the presence of some Calcium Carbonate. Results follow:

	<u>Sample No. 1</u>	<u>Sample No. 2</u>
% Soluble Water - 100°C	7.07	59.37
% Insoluble	92.93	40.63
	<u>100.00</u>	<u>100.00</u>

Analysis of Soluble Portion

Sodium Sulphate	7.09	0.58
Sodium Chloride	17.30	0.50
Sodium Carbonate	Trace	Trace
Sodium Nitrate †	75.61	98.92
	<u>100.00</u>	<u>100.00</u>

† By difference.

The material is evidently a water deposit of sodium nitrate accompanied by relatively small amounts of other sodium salts, the impurity being rock and soil material included during the sampling. The nitrate itself could easily be leached from the detritus and recrystallized if the deposit justifies such operations.

Very truly yours,

G. W. Gleeson

George W. Gleeson,
Professor of
Chemical Engineering

GWG:jn

Assay
17

April 12, 1939

Mr. C. C. Anderson
Jordan Valley, Oregon

Dear Mr. Anderson:

We have taken the liberty of sending your samples which you report as sodium nitrate to Dr. G. W. Gleeson of the Department of Chemical Engineering at Oregon State College. The reason for this is that we are not well equipped at our State Assay Laboratory for handling non-metallic minerals. I have advised Dr. Gleeson of the source of this material and of your name and asked for a determination. You will either hear directly from Dr. Gleeson or from me in due time.

After we learn the result, we will be in a better position to advise you in regard to the deposit in question.

Thanking you, I am

Very truly yours,

EKN:vm

Director

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APR 6 1939

STATE DEPT. GEOLOGY
& MINERAL INDS.

Jordan Valley Oregon
April 2, 1939.

State Mining Board
Salem Oregon

Dear Sir:

I'm sending you a sample of sodium nitrate
Rock. I wish a report on.

I have a large deposit of this mineral.
You may be able to advise me of some
firm that would be interested in this
kind of mineral.

Thanking you very kindly
Very truly yours.

C. C. Anderson.

Material sent to Dr. Gleason McCorralis
4-11-39

April 12, 1939

Dr. G. W. Gleeson
Department of Chemical Engineering
Oregon State College
Corvallis, Oregon

Dear Doctor Gleeson:

Under separate cover I am sending you two samples, tied together, of material sent in by Mr. C. C. Anderson of Jordan Valley, Oregon. Anderson reports this as sodium nitrate and wishes to have a report on it.

If you have facilities for assaying or analyzing this material, I would be very pleased to have you do it. As you know, we are not well equipped for non-metallic analyses at our laboratories and don't do enough of it to keep in trim. If this job will embarrass you in any way, please advise me and I will have it taken care of in some other manner.

Thanking you, and with best wishes, I am

Sincerely yours,

EKN:vm

Director

Greensand

August 16, 1944

Mr. Hans Norbistrath
U. S. Geological Survey
MacDonald Hotel
Vernonia, Oregon

Dear Hans:

Petrographic analysis of the sample you brought in to Mr. Libbey shows it is made up of about 45 percent glauconite-like material; about 48 percent opaline and chalcedonic material; and about 7 percent angular plagioclase grains and basaltic fragments. The granules or grains of glauconite ^{like material} are round or oval in outline, for the most part, and the spaces between the grains are filled with colloidal silica. The plagioclase grains are slightly larger than the glauconite-like material, and I think they and the basaltic fragments may be of eruptive origin, as they constitute the only impurity other than the silica. For the most part the green grains fit the properties of glauconite, but spectrographic analysis shows that only silica and iron are present in appreciable amounts and that practically no potassium is present. The silica content is well over 10 percent and the iron approximately 10 percent. Aluminum, magnesium, calcium, and sodium are probably present in the amount of 1 percent and several other elements are present in very minor amounts. It appears that the glauconite-like material is mainly a hydrous iron silicate and the only one described which resembles glauconite is greenalite, a hydrous iron silicate. As there is very little data available on that mineral, which is usually described as amorphous, I cannot be certain of its identification in the thin section. However, there is a picture of a thin section of greenalite in Lindgren which this section resembles rather well.

As the water-softening properties of glauconite depend on its exchangeable potassium content, little importance can be attached to the sample you brought in. I recall your mentioning that other of the green sands had a calcite matrix, and I am wondering whether or not they may be glauconite. Anyway we would appreciate samples from the other localities you mentioned, if you can arrange getting them without too much difficulty. I certainly hope I can take advantage of your invitation to come up and look over the area with you.

Very truly yours,

W. D. Lowry
Assistant Geologist

WDL:ff