

RESULTS OF ZIRCON Sampling

Yaquina Bay

6120304

Run

- 1 (A) Sta. 1 Under S. pier of bridge 3.0% ZrO_2 SiO_2 2.9
- 2 (B) Lower 2' South of ferry landing (under bridge) 15' E. of stop sign 0.6% 1.75
 ZrO_2 SiO_2
- 3 (C) 12' sample Sta. under south end of bridge. 0.11
- 4 (D) In road cut 2 mi. N. of Newport .53% ZrO_2 SiO_2 Pleistocene sands .51
- 5 (E) Bottom 1 foot 200' E. of highway opposite stop sign 1.1% ZrO_2 SiO_2 1.2.9
- 6 (F) Upper 2' S. of ferry landing 150' east of stop sign 0.5% ZrO_2 SiO_2 Same

(Hammond Hole No. 1 Sample 2 Trace)

- (A) Heads: Am
Nil
- (B) conc. : .02
- (C) " : "
- (D) " : Tv.
Conc. : .16 02
- (E) " : .2 02
Heads : Tv
- (F) " : .12 02
- Hammond conc. .2 02

ILMENITE CONTENT OF OREGON COASTAL SANDS

Ilmenite has been known for many years to make up a substantial percentage of the black sand deposits along the Oregon coast. The earliest analytical work done by Day and Richards (2) showed that the percentages varied up to 55 percent in a few cases. Many of the analyses showed "ilmenite and/or chromite", but for the portion of the coast north of the Siuslaw River it has been shown that ilmenite is predominant and chromite minor, with the relationships reversed south of Coos Bay. The following mineralogical analyses are those by Day and Richards (2) which show more than 10 percent ilmenite:*

<u>No.</u>	<u>Location</u>	<u>Lbs./ton</u>	<u>Percent</u> <u>(Calc.)</u>
P-443	Marshfield	467	23.0
P-375	Bullards	676	34.0
P-102	Randolph district	216	11.0
P-102	Randolph district	583	29.0
P-102	Randolph district	202	10.0
P-102	Randolph district	893	44.5
P-102	Randolph district	235	11.7
R-3043	Randolph district	1,500	75.0
R-3044	Randolph district	1,100	55.0
R-3042	Randolph district	200	10.0
R-3078	Bandon Beach	300 *	15.0
P-727	Coos Bay	228 *	11.0
P-274 A	Yaquina Bay	540 *	27.0
P-274 A	Yaquina Bay	572 *	28.6
P-274 B	Yaquina Bay	546 *	27.0
P-732 A	Newport	662 *	33.0
P-732 C	Newport	192 *	9.6
R-3065	Oretown	1,100 *	55.0

* Pounds per ton ilmenite alone. Others represent ilmenite and/or chromite.

In the southern portion of the coast, only one analysis for titanium is given (for the Chickamin Mine on South Slough) of "from 10 to 15 percent TiO_2 " (3, 4, 5). It is generally listed as being minor in amount, and considerably less than the chromite and magnetite content.

Estimates given by Twenhofel (7) of the amounts of black sand and ilmenite and/or chromite of the largest of the deposits on the beaches are as follows:

Heceta Beach around Sutton Creek: 7000 to 8000 yards of concentrate, containing 3500 tons of ilmenite and/or chromite.

Beach north of Big Creek: 1000 yards containing 14 percent black minerals.

South of Buckley Creek: 2 feet thick, 1000 cubic yards, containing 25 percent ilmenite and/or chromite.

Newport Beach: 2000 cubic yards containing 55 percent ilmenite and/or chromite (about 2750 tons).

North of Jump-Off-Joe: 8000 cubic yards containing 53.45 percent ilmenite and/or chromite (about 12,800 tons).

Yaquina Bay: 1000 to 15,000 yards, containing 31.5 percent ilmenite and/or chromite (about 6300 tons).

Mouth of Columbia River: 15,000 to 30,000 yards containing 15 percent ilmenite.

Deposits at the mouth of the Columbia River were investigated in 1941, with the following results:

McGowan deposit, north side of mouth of Columbia River, Wash. Reportedly 300,000 tons of black sand, composed of 35 percent ilmenite and 52 percent magnetite (calculated).

Hammond deposit, in town near boundary of Fort Stevens (1) Lens of black sand at least 300 x 800 feet, from 3 to 4 feet thick.

Twenhofel sampled the beach sand concentrations along the northern coast (7) and his mineralogical results, when they show ilmenite and/or chromite amounting to more than 25 percent, are given as follows:*

Near Peter Iredale wreck, Clatsop Spit (7)

Dune sand concentration, 40.24 percent ilmenite and/or chromite.

South jetty, Columbia River (7)

Dune sand concentration, 34.5 percent ilmenite and/or chromite.

North side of south jetty, Columbia River (7)

Dune sand concentration, 22.5% ilmenite and/or chromite.

Top of jetty on north side of Columbia River (7)

Dune sand concentration, 23.3 percent ilmenite and/or chromite.

Northeast of south jetty, Columbia River (7)

Dune and wave concentration, 25 percent ilmenite and/or chromite.

East side of Trestle Bay, 2 foot channel sample (7)

25.46 percent ilmenite and/or chromite.

Dock on Sand Island, high tide level. (7)

27.53 percent ilmenite and/or chromite.

Netarts Bay, east end, high tide level. (7)

43.95 percent ilmenite and/or chromite.

Four miles north of Neskowin Creek (7)

25.85 percent ilmenite and/or chromite.

Beach south of Terra Del Mar (7)

6 inch channel, high tide level. 52.04 percent ilmenite and/or chromite.

Terra Del Mar, little creek at north end. (7)

6 inch channel, 30.1 percent ilmenite and/or chromite.

South of Cape Lookout (7)

Beach at foot of cliff, 29.92 percent ilmenite and/or chromite.

Delake, bank of stream, high tide level (7)

25.65 percent ilmenite and/or chromite.

* Location map in Twenhofel (7)

Delake, 1800 feet north, foot of cliff (7)
46.8 percent ilmenite and/or chromite.

Surf Tides Hotel, one-half mile north. (7)
Deposit 20 x 100 feet, 79.35 percent ilmenite and/or chromite.

Surf Tides Hotel, 2 miles north. (7)
33.52 percent ilmenite and/or chromite.

South of Cascade Head, foot of cliff (7)
44.64 percent ilmenite and/or chromite.

South Beach, Yaquina Bay (7)
50.5 percent ilmenite and/or chromite
26.20 percent ilmenite and/or chromite
36.55 percent ilmenite and/or chromite
26.12 percent ilmenite and/or chromite
33.60 percent ilmenite and/or chromite
38.15 percent ilmenite and/or chromite
31.50 percent ilmenite and/or chromite

Agate Beach, 600 feet north of Big Creek (7)
67.12 percent ilmenite and/or chromite.

Agate Beach, 1000 feet south of Big Creek (7)
62.84 percent ilmenite and/or chromite.

Agate Beach, at Big Creek (7)
44.72 percent ilmenite and/or chromite.

Agate Beach, south end, south of Big Creek (7)
39.15 percent ilmenite and/or chromite.

Newport Beach at pavilion (7)
55.0 percent ilmenite and/or chromite.

Seal Rock, one mile north (7)
Bed 3 feet 6 inches thick, 50.53 percent ilmenite and/or chromite.

Buckley Creek, south of Seal Rock (7)
34.24 percent ilmenite and/or chromite.

Alsea River mouth, south side (7)
Bed 1 foot thick, 54.93 percent ilmenite and/or chromite.

Big Creek, first creek north of (7)
42.8 percent ilmenite and/or chromite.

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BIBLIOGRAPHY

- (1) Allen, J. E., Hammond black sands: Oreg. Dept. of Geol. & Min. Ind., unpub. rept., 1941.
- (2) Day, D. T., and Richards, R. H., Useful minerals in the black sands of the Pacific slope: U.S. Geol. Survey, Min. Res. of the U. S. for 1905 (1906); Black sands of the Pacific slope: U.S. Geol. Survey Bull. 285, 1905.
- (3) Horner, R. R., Notes on the black sand deposits of southern Oregon and northern California: U.S. Bureau of Mines Tech. Paper 196, 1918.
- (4) Leaver, Edmund S., Auriferous black sands of the Pacific coast: U.S. Bureau of Mines R.I. 3275, June 1935.
- (5) Pardee, J. T., Beach placers of the Oregon coast: U.S. Geol. Survey Circular 8, 1934.
- (6) Twenhofel, W. H., Origin of the black sands of the coast of southwest Oregon: Oreg. Dept. Geol. & Min. Ind., Bull. 24, 1943.
- (7) Twenhofel, W. H., Mineralogical and physical composition of the sands of the Oregon coast from Coos Bay to the mouth of the Columbia River: Oreg. Dept. Geol. & Min. Ind., Bull. 30, 1946.

John Eliot Allen
February 28, 1947

JOHNSON PROCESS

Chromite Recovery — Oregon Beach Sands

May 18, 1942

During the past two years we have made several tests on samples of Oregon beach sands which have been submitted to us from various deposits.

All of our tests have shown a combined process treatment as the most suitable procedure. First, a wet gravity concentration is indicated to eliminate any overburden, sand, etc., and to produce a rough gravity concentrate consisting of the heavier minerals, such as ilmenite, magnetite, chromite, zircon, gold and platinum. Next, these heavier minerals may be dried and then separated electrostatically. Finally, if it is possible and profitable to produce higher chrome-iron ratio concentrates, a further separation of the electrostatic concentrates may be made magnetically to remove any free magnetic iron minerals, and iron filings produced by wear on the handling equipment.

For the tests covered in this report, we have selected three samples which we believe represent the so-called "black sands". In chromite content these will nearly equal gravity-separation rough concentrates, when operating the gravity concentrators for the production of clean tailings and highest recovery of chromite.

In order to provide representative working conditions, we divided each sample into duplicate head feeds, one to be concentrated by wet jigs and electrostatic, the other by wet tables and electrostatic.

The object of these tests is to indicate the efficiency of the combined concentrating treatment in recovering chromite concentrates to meet the requirements of the Metals Reserve Company at highest recovery and lowest cost.

(Test No. 1582 (Sample No. 1))

Wet Jig — Electrostatic

Wet Jig Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Head feed	100.00	24.74	24.74	100.0
Concentrates	72.30	29.60	21.40	86.5
Middlings	8.70	24.00	2.09	8.4
Tailings	19.00	6.60	1.25	5.1
	100.00		24.64	100.0

Recovery of Cr₂O₃ — 95.70%

Ratio of Concentration 1.27 : 1

Note: Middlings returned to head feed in circulation.

Chromite
Black Sands

Electrostatic Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Jig Concentrates (head feed)	100.00	29.60	21.40	100.00
Concentrates	61.30	41.15	25.22	85.23
Middlings	6.80	33.15	2.25	7.61
Tailings	<u>31.90</u>	7.65	<u>2.12</u>	<u>7.16</u>
	100.00		29.59	100.00

Recovery of Cr₂O₃ -- 91.08%

Ratio of concentration -- 1.53 : 1

Note: Middlings returned to head feed in circulation.

Combined recovery of Cr₂O₃ -- 87.16%

Ratio of Concentration -- 1.94 : 1

Test No. 1583 (Sample No. 2)

Wet Jig -- Electrostatic

Wet Jig Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Head Feed	100.00	26.22	26.22	100.0
Concentrates	88.20	27.37	24.14	92.0
Middlings	5.30	24.40	1.29	4.9
Tailings	<u>6.50</u>	12.65	<u>.82</u>	<u>3.1</u>
	100.00		26.25	100.0

Recovery of Cr₂O₃ -- 96.23%

Ratio of Concentration -- 1.08 : 1

Note: Middlings returned to head feed in circulation

Electrostatic Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Jig Concentrates (head feed)	100.00	27.37	27.37	100.0
Concentrates	63.50	41.59	26.40	96.5
Middlings	2.30	23.50	.54	2.0
Tailings	<u>34.20</u>	1.24	<u>.42</u>	<u>1.5</u>
	100.00		27.36	100.0

Recovery of Cr₂O₃ -- 98.4%

Ratio of Concentration -- 1.54 : 1

Note: Middlings returned to head feed in circulation.

Combined recovery of Cr₂O₃ -- 94.69%

Ratio of Concentration -- 1.66 : 1

Test No. 1584 (Sample No. 3)

Wet Jig — Electrostatic

Wet Jig Concentration

Products	% Weight	% Cr ₂ O ₃	Units	Distribution
Head Feed	100.00	25.45	25.45	100.00
Concentrates	69.20	29.30	20.27	79.6
Middlings	12.00	27.00	3.24	12.7
Tailings	<u>18.80</u>	<u>10.50</u>	<u>1.97</u>	<u>7.7</u>
	100.00		25.48	100.0

Recovery of Cr₂O₃ — 91.55%

Ratio of Concentration — 1.26 : 1

Note: Middlings returned to head feed in circulation.

Electrostatic Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Jig Concentrates (head feed)	100.00	29.30	29.30	100.0
Concentrates	61.7	41.68	25.70	87.9
Middlings	7.0	32.30	2.26	7.7
Tailings	<u>31.3</u>	<u>4.13</u>	<u>1.29</u>	<u>4.4</u>
	100.0		29.25	100.0

Recovery of Cr₂O₃ — 95.35%

Ratio of Concentration — 1.49 : 1

Note: Middlings returned to head feed in circulation.

Combined recovery of Cr₂O₃ — 87.29%

Ratio of Concentration — 1.88 : 1

Test No. 1585 (Duplicate Sample No. 1-A)

Wet Table — Electrostatic

Wet Table Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Head Feed	100.00	24.56	24.56	100.0
Concentrates	74.60	28.10	20.96	85.0
Tailings	<u>25.40</u>	<u>13.87</u>	<u>3.52</u>	<u>14.4</u>
	100.00		24.48	100.0

Recovery of Cr₂O₃ — 85.95%

Ratio of Concentration — 1.33 : 1

Electrostatic Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Table Concentrates				
(Head Feed)	100.00	28.10	28.10	100.0
Concentrates	53.70	40.20	21.59	76.6
Middlings	11.70	27.50	3.23	11.5
Tailings	34.60	9.68	3.35	11.9
	<u>100.00</u>		<u>28.17</u>	<u>100.0</u>

Recovery of Cr₂O₃ -- 86.34%

Ratio of Concentration -- 1.66 : 1

Note: Middlings returned to head feed in circulation

Combined recovery of Cr₂O₃ -- 74.21%

Ratio of Concentration -- 2.21 : 1

Test No. 1586 (Duplicate Sample No. 2-A)

Wet Table -- Electrostatic

Wet Table Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Head Feed	100.00	26.22	26.22	100.0
Concentrates	90.70	27.24	24.70	94.3
Tailings	9.30	16.15	1.49	5.7
	<u>100.00</u>		<u>26.19</u>	<u>100.0</u>

Recovery of Cr₂O₃ -- 91.92%

Ratio of Concentration -- 1.15 : 1

Electrostatic Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Table Concentrates				
(Head Feed)	100.00	27.24	27.24	100.0
Concentrates	62.80	41.59	26.11	96.0
Middlings	2.40	28.30	.67	2.5
Tailings	34.80	1.20	.41	1.5
	<u>100.00</u>		<u>27.19</u>	<u>100.0</u>

Recovery of Cr₂O₃ -- 98.45%

Ratio of Concentration -- 1.55 : 1

Note: Middlings returned to head feed in circulation

Combined recovery of Cr₂O₃ -- 90.5%

Ratio of Concentration -- 1.78 : 1

Test No. 1587 (Duplicate Sample No. 3-A)

Wet Table — Electrostatic

Wet Table Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Head Feed	100.00	25.31	25.31	100.0
Concentrates	91.50	26.59	24.32	95.6
Tailings	8.50	13.29	1.12	4.4
	100.00		25.44	100.0

Recovery of Cr₂O₃ — 94.4%
Ratio of Concentration — 1.11 : 1

Electrostatic Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Table Concentrates (Head Feed)	100.00	26.59	26.59	100.0
Concentrates	54.40	40.49	22.02	83.0
Middlings	12.40	27.98	3.46	13.0
Tailings	33.20	3.24	1.07	4.0
	100.00		26.55	100.0

Recovery of Cr₂O₃ — 95.45%
Ratio of Concentration — 1.61 : 1
Note: Middlings returned to head feed in circulation
Combined recovery of Cr₂O₃ — 90.62%
Ratio of Concentration — 1.77 : 1

The chrome-iron ratio of the electrostatic concentrates is as follows:

Test No.	Cr ₂ O ₃	FeO	Ratio
1582	41.15	28.17	1.285 : 1
1583	41.59	28.44	1.29 : 1
1584	41.68	28.26	1.30 : 1
1585	40.20	26.73	1.32 : 1
1586	41.59	28.53	1.28 : 1
1587	40.49	29.48	1.21 : 1

A composite sample of the electrostatic concentrates produced in these tests contained 41.15% Cr₂O₃ and 28.27 FeO. The Chrome-iron ratio was 1.280 : 1.

These concentrates meet the "Low Grade B" Specifications with a base price of \$24.00 per long dry ton for ore containing 40.0% Cr₂O₃, with an increase of \$.60 per ton for each unit or fraction in excess of 40.0% Cr₂O₃. The value of the average electrostatic concentrates is \$24.69 per long ton.

The combined electrostatic concentrates from these tests were passed over a magnetic separator to remove any free magnetic iron minerals and iron from the wear on handling equipment.

Magnetic Concentration

Products	% Weights	% Cr ₂ O ₃	Units	Distribution
Electrostatic Concentrates (Head Feed)	100.00	41.15	41.15	100.0
Magnetic Concentrates	86.50	44.84	38.79	94.5
Magnetic Tailings	13.15	16.74	2.26	5.5
	<u>100.00</u>		<u>41.05</u>	<u>100.0</u>

Recovery of Cr₂O₃ — 94.65%
Ratio of Concentration — 1.15 : 1

The Cr₂O₃ is increased 3.69% and the FeO is reduced from 28.27% to 25.47% which changes the chrome-iron ratio from 1.28 : 1 (electrostatic concentrates) to 1.55 : 1 (Magnetic Concentrates), increasing the chromite value from \$24.69 per ton to \$26.90 per dry long ton.

In increasing the Cr₂O₃ content by magnetic separation, we have slightly increased production cost and lost as tailings 13.15% by weight, which should not be put back in the head feed. Therefore, we have the following comparison:

100 tons Electrostatic Concentrates averaging 41.15% Cr ₂ O ₃	
@ \$24.69	\$ 2,469.00
86.5 tons Magnetic Concentrates averaging 44.84% Cr ₂ O ₃	
@ \$26.90	\$ <u>2,326.85</u>
Difference	\$ 143.15

There appears to be a metallurgical limit, as well as an economical limit, to mechanical concentration, with regard to increasing the chrome-iron ratio to the "Low Grade A" classification requiring a 2 : 1 ratio.

The new roasting and leaching process developed by the Bureau of Mines however, combined with mechanical concentration, should produce the highest-grade chromite from the Oregon beach sands.

Respectfully submitted,

RITTER PRODUCTS CORPORATION

(Signed) R. B Packer

Research Engineer

State of Oregon
Department of Geology & Mineral Industries
Portland, Oregon
.. Earl K. Nixon, Director

Sec. _____ T. 8N R. 10W

Date 3/14/40

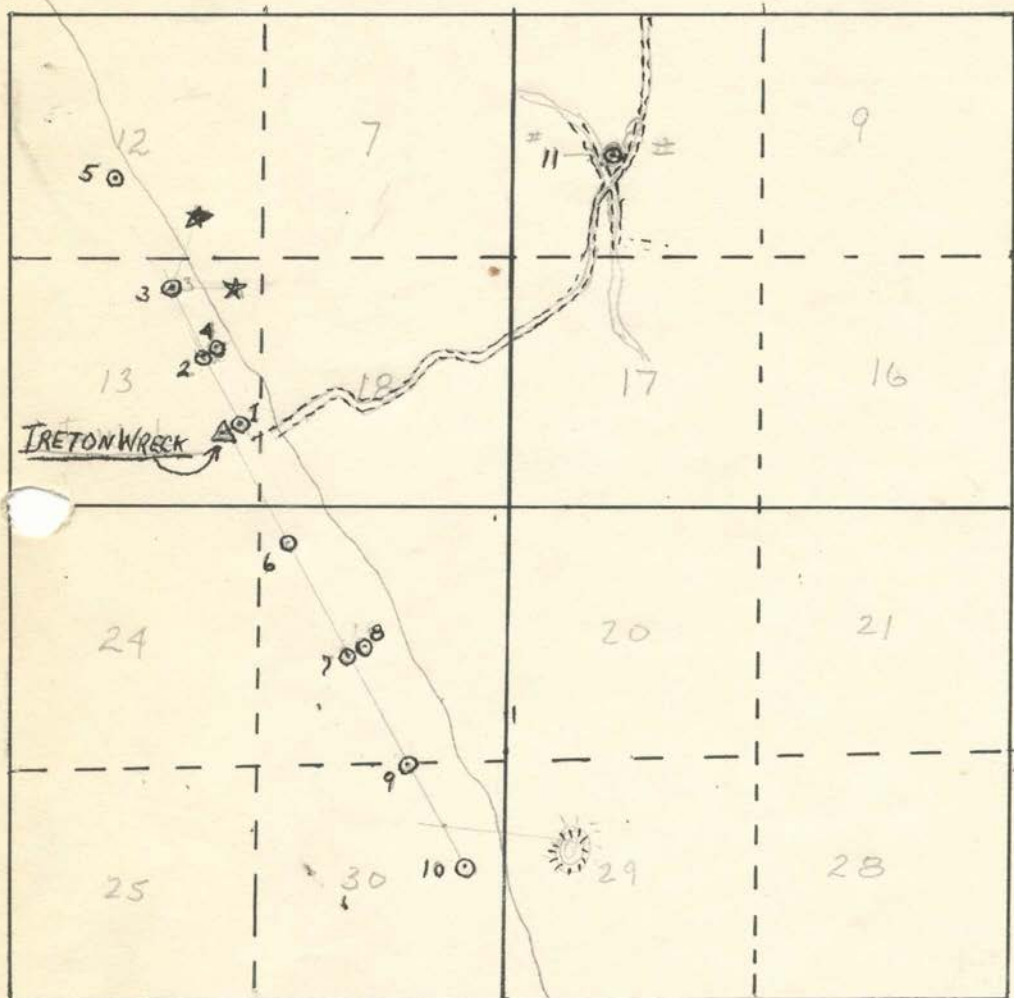
Name of Survey Black Sand sample locations.

County Clatsop Co.

Quadrangle _____

Notebook Page No. _____

Scale: 1000 ft. 1 inch



See Astoria Quad.

BEACH AND DUNE SAND SAMPLES

taken 14 March 1940

by F.W. Libby and J.E. Allen

Location: Clatsop County, T. 8 N, R. 10 and 11 W. in sections 8, 19, 30, R. 10 W., and 12 and 13 R. 11 W.

Landmark from which all the samples were measured was the wreck of the Ireton, located near the center of the E. $\frac{1}{2}$ of Sec. 13, T. 8 N., R. 11 W.W.M. Clatsop County, Oregon.

Samples as follows:

- #1 Beach sand, pit 2 feet deep (water). 310' N.55°E. from bow of Ireton, back of forebeach.
- #2 Beach sand, pit 3' deep. 1000' N.30°W. of #1 (paced). N.7° W. from bow of Ireton. Back of forebeach.
- #3 Beach sand, pit 2 $\frac{1}{2}$ feet deep. 1000' N.27°W. of #2. Navigating markers to N.19°E. and due E. N.20° W. from Ireton prow.
- #4 200' N.60°E. of #2, on back side of first dune ridge. Four feet deep pit.
- #5 (This and following samples were not paced, but were measured with speedometer on Ford coupe, which runs about .1 mile slow.) 1.1 miles along beach northwards of Ireton prow, at point where forebeach narrows. Cut in first dune by last storm, sample across 8.5 feet.
- #6 Pit 3 feet deep, 0.5 miles S.30°W. of Ireton prow.
- #7 Pit 3 " " 1.0 " " " " "
- #9 " 2.5 " " 1.5 " " " " "
- #10 " " " " " " " " "

The foregoing four samples were all taken at the back side of the forebeach, just in front of the first dune ridge, at the lowest point.

- #8 Pit 2.5 feet deep on back side of first dune ridge 285 feet N.70°E. of #7.
- #11 Sample across 5 feet (vertical) of sand in road cut on W. side of road 100 yards N. of forks towards Hammond (3/4 north) in center of S.W. $\frac{1}{4}$ of sec. 8.

Sand reserves 3 miles long, 2000 feet wide by 10 feet deep should give over 10 million tons.

John Eliot Allen , geologist

Corvallis, OR
(Benton Co.)
Gazette-Times
(Cir. D. 14,088)

Ging
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DEC 19 1985

Allen's P. C. B Est. 1888

Grant supports research on chromite along coast

By Oregon State University

Both the Oregon coast and waters near shore are known to contain deposits of chromite, the mineral source of chromium, but scientific data about how extensive these deposits are and how accessible they might be have not been collected. Two Oregon State University marine geologists have received a grant to collect this information.

The research is timely, said the principal researcher, because of renewed interest in developing domestic sources of chromium. Oceanography professor LaVerne Kulm noted that the United States currently imports all its chromium, much of it from South Africa and the Soviet Union.

The \$35,000 research grant has been awarded by the Oregon Department of Geology and Mineral Industries to Kulm and Curt Peterson, an oceanography research associate. Kulm, who directed OSU research into offshore mineral deposits on the continental shelf in the late 1960s and early 1970s, said that the main purpose of the new research is to inventory all the existing geological and geophysical data on heavy mineral deposits in the

beaches, beach terraces and offshore continental shelf, from northern California to southern Washington.

Heavy minerals include not only chromite but ilmenite, the mineral source of titanium, another important industrial metal.

The emphasis of the inventory would be on data concerning Oregon, said Kulm.

The study is viewed as a first stage in evaluating the potential for chromite mining in Oregon. It is expected to be concluded by April 1986.

Oregon undersea ore mining could be easy

Chromium ore deposited underseas along the Oregon coast could be mined economically and environmentally harmless, according to a development consultant.

Cliff McLain said at Newport, Ore., that the project would be relatively simple mining. He said Oregon's above-water black sand beaches were mined for gold in the 19th century and that some gold and platinum probably would be produced in new mining.

McClain added that Oregon State University studies suggest that chromite deposits in quantities could allow Oregon to challenge South Africa, the leading producer, in the Japanese market.

The chromite market is said to be expanding worldwide as much as 15 percent annually. McClain said the mineral is alloyed with

iron to make chromium and such an operation in Oregon would quintuple the economic benefits of the mining project. The Soviet Union is the other main producer of chromite.

The Oregon Division of State Lands has called a hearing in Portland and McClain said he would testify in favor of rules that would give successful offshore prospectors preferential rights on drowned ice age beaches near the shore. He said the state should change its rules to attract venture capital for the offshore exploration.

McClain is a former chief scientist for Systems Planning Corp., a Defense Department contractor. He is now a director of Marine Development Associates Inc. of Fairfax Station, Va., a consulting firm involved in several mining and energy ventures.

SOURCE: THE WALLACE (ID) MINER

DATE: AUGUST 7, 1986

COMMODITY SECTION: FERROUS

STATE ARTICLE CONCERNS: OREGON

Scientist to return 5018 to coast

By Susan Wehren
Staff Writer

Cliff McClain, chief scientist for Marine Development Associates, Inc., plans to return to the coast later this month to again discuss offshore chromite mining.

McClain was in Lincoln County in November of last year and at that time met with local and state officials about mining possibilities off the Oregon coast.

His visit this time will be to meet with state and local government officials to determine the feasibility of the offshore chromite development research.

He will also discuss with Toledo officials the necessary requirements to have a processing plant located in the city if research is successful, according to Todd Holm of the Yaquina Economic Development Consortium.

McClain will meet with state officials the end of May and then come to Lincoln County the first of June.

According to Holm, McClain is "very encouraged by the response from the state, although the state has not proceeded as fast as was originally anticipated."

In November, Tom Becker of Newport reported that a two year mineral deposit research study would involve getting a core sample. A hollow core drill would be driven 40 feet into the sand by sinking a tube 40 feet into the sand every 100 feet anywhere from one mile to three miles offshore. This sample area could be as large as from Coos Bay to Tillamook.

A \$350 million plant could produce two million tons of chromium in 20 years, assuming a 20-year source of minerals. From this, 1,000 jobs and \$50 million in yearly sales could be generated, McClain said last fall.

John Byrne, president of Oregon State University, said in November that a good chromite resource could end the problem of importing the mineral. Eighty percent of America's chromite is imported from South Africa, the USSR and the Philippines.

It is possible, said Holm, that the \$5 million funding for the initial research may be committed in the near future.

Holm, whose job ends in June, has worked closely with McClain and says he hopes someone else will be able to pick up the consortium's work. A local connection to keep McClain and his associates informed about "local feelings", laws and to work with and identify ocean user groups and others that would be affected by the research is needed, said Holm.

Offshore mining backed

NEWPORT (AP) — Mining undersea deposits of chromium ore could boost the Oregon coastal economy if the state changed rules to attract venture capital for offshore exploration, a development consultant says.

But consultant Cliff McClain accused the Division of State Lands of ducking the issue in proposed rules coming up for a hearing Friday in Portland.

McClain said Tuesday he would testify in favor of rules that would give successful offshore prospectors preferential rights to exploit their finds.

Tom Becker, the Newport entrepreneur who recently organized Oregon Salmon Development Corp. to buy Oregon Aqua Foods, said he was interested in McClain's proposal to mine black sands on drowned Ice Age beaches near the shore.

McClain said he was a former chief scientist for Systems Planning Corp., a Defense Department contractor. He said he now was a director of Marine Development Associates Inc., a Fairfax Station, Va., consulting firm, and was involved in several mining and energy ventures.

He said suggestions he submitted last year to the Land Board on mineral survey rules had no apparent effect on the regulations that have been proposed.

McClain said the exploration and mining of chromite in black sands would be environmentally harmless and relatively simple.

Oregon's above-water black sand beaches were mined for gold in the 19th century, McClain said, and some gold and platinum probably would be produced by an offshore project.

Worldwide, the chromite market is expanding as much as 15 percent annually, he said. Most of the mineral is alloyed with iron to make chromium, and McClain said performing that operation in Oregon would quintuple the economic benefits of the mining project.

John D
Greg
Dennis

RECEIVED-PTU

JUN 5 1986

DEPT. OF COMMERCE

SOURCE: THE (PORTLAND) OREGONIAN

DATE: JUNE 5, 1986

COMMODITY SECTION: FERROUS

STATE ARTICLE CONCERNS: OREGON

NOV 1 1985

Allen's P. C. B Est. 1888

Editorials

Chromite mining

Don't get excited

5018
Shades of the 1950s. The federal government once again is ready to encourage the mining of Oregon chromite as foreign sources of the ore are threatened.

Despite having a wide variety of minerals within our borders, this country is increasingly vulnerable to the threats of foreign suppliers.

Because of cheap labor elsewhere and more adequate supplies, foreign sources of minerals — along with petroleum — usually are less expensive than domestic ones.

So the bottom line dictates we risk importing these essential materials, until a threat arouses our fears. In this case, it is our deteriorating relationship with South Africa, our chief supplier of chromite.

The Soviet Union is our No. 2 supplier, which is hardly reassuring.

Chromite lies in pods in the Southern Oregon mountains, leaching its way to the beach sands where it was first discovered.

Aircraft development in World War II increased the demand for chrome and led to exploration and mining.

During the Korean War the federal government launched a massive stockpiling of essential ores, including chrome. Government subsidies encouraged the reopening of the Oregon chrome mines.

Most of those old mines are exhausted, and because the ore comes in pods rather than extensive veins, it is relatively difficult to locate.

Nature, however, has provided a means of collecting the stuff as it washes to sea and is becomes part of the beach sand.

Such mining, however, is expensive and can raise environmental concerns. Unlike conventional mining, where the miners stake claims, the beach mining and undersea mining provides no protection for the developers.

Officials from the U.S. Interior Department's Minerals Management Service alerted a conference on ocean mining at Newport recently to the renewed interest in Oregon chrome, both by the government and by companies wanting to do the mining.

When this situation arose the last time, in the early 1950s, Oregon welcomed the reopening and expanding of the old chromite mines, looking to the development of a mining industry.

But the federal government's interest in the stockpiling soon waned, the subsidy ended and with it the mining industry.

We should be skeptical of this renewed surge of interest, especially with its environmental implications along our beaches and offshore areas.

The history of chrome development in Oregon raises more doubts than hopes.

Oregonian 11/16/65

East Coast group eyes ocean chromium mining

By CARMEL FINLEY

Correspondent, The Oregonian

NEWPORT — An East Coast research and development group is interested in funding an exploratory study of the potential of mining chromium from the sand on the ocean floor off Oregon.

Cliff McClain of Marine Development Associates Inc. said this week he wants to fund the research in return for "a patent or a right of first refusal to develop what is found."

The United States currently imports about 80 percent of its chromium, mostly from the Soviet Union and South Africa, said McClain. The mineral was mined off Oregon during World War II.

The technology exists to mine chromium offshore and a plant to process the sand could cost between \$200 million and \$500 million, McClain said. He projected a return of \$1.5 billion over the next 20 years.

The early exploratory studies, which would be conducted by Oregon State University, would cost between \$4 million and \$5 million, McClain said.

McClain said he had been exploring the concept with officials from the division of state lands and the Economic Development Administration, as well as with the governor's office.

"We're looking for a feeling of sufficient consensus for us to put in a proposal," said McClain, adding that the response had been favorable. He said he had not made a concrete funding proposal to Oregon State, but suggested \$2.6 million to the university for the research studies. His proposal would include hiring two ships that would employ 40 people to do the exploration, with an additional 20 back-up scientists stationed at the Mark O. Hatfield Marine Science Center in Newport.

"We would make it as much as possible an Oregon investment opportunity," said McClain. "I know where some of the money is coming from. I don't want to assemble a partnership until the timing is appropriate within the state. It would be an Oregon-based partnership."

John Byrne, Oregon State University president, said the university would be interested in doing the research.

"We know relatively little about the heavy mineral concentration in the ocean," said Byrne. "We don't know the distribution or the richness."

McClain said he hoped research would show a potential source for a 2 million-ton chromium mine, which would require six offshore deposits, each a mile long by 1,000 feet wide and 10 feet deep.

If the chromium concentration was a minimum 20 percent, the mining effort could be sustained for 20 years, he said.

The processing could be done at sea, using a mechanical process to separate heavy ores from light ores. Reducing the ore to metal would be done onshore.

McClain estimated the development could mean 1,000 jobs, most of them based in the Newport area.

Byrne said two small studies done by the university have shown areas of rich deposits off the coast, but a lack of research funds has stalled further developments. He estimated most of the potential mining would take place within three miles of shore.

Byrne said the mining would not be a major problem, and that a dredge hopper would be used to suction the loose sand.

The chromium content of black sand found at Otter Rock has run from 20 to 40 percent, McClain said. One of the first things that would be studied would be what concentrations are offshore, and if the minerals are diffused over the ocean floor or deposited in layers that could be mined.

Black sand may hide wealth

Statesman Journal 1/26/84

CORVALLIS (AP) — Black gold lies along the central and southern Oregon coast.

Not only does the dark sand contain gold, it holds chrome and titanium as well, three Oregon State University researchers say.

Chrome is used to make steel rust-resistant, and titanium is used in jet-engine parts. So the minerals are of both industrial and strategic importance.

Their existence in Oregon coastal areas could develop into a major asset for the state's economy, the researchers say.

"Many people notice the black sands, but they probably think they're seeing oil or some pollutant," said Paul Komar, one of the researchers. The black sand is actually concentrations of heavy minerals.

Other caches have been found in the terraces adjoining beaches and in the offshore continental shelf.

Ken Scheidegger, another researcher, estimates that one typical deposit on a beach near Newport is about 1½ miles long, 100 yards wide and one yard thick. It may contain a million tons of black sand, yielding 13-14 percent chromite, the mineral from which chromium is extracted.

Scheidegger compares the mining potential of the black sands favorably with mineral sulfides that are expected to be sought in the more remote deep-ocean Gorda Ridge.

The total chromium believed contained in Oregon coastal deposits would make them the second-largest in the state, he said.

"The United States now obtains most of its supplies of this essential industrial metal from Russia and South Africa, and more stable sources of supply would be desirable," Scheidegger said.

Gold has been mined along south coast

beaches since the state was settled, and small mines are in operation near Bandon. However, the other minerals are believed far more abundant.

Beach erosion and wave action have concentrated the heavy minerals to deposits greater than 90 percent "heavies," Komar says.

Beach deposits with similar concentrations are likely to be found from Bandon to Newport, Scheidegger believes. The deposits in the continental shelf may be even more substantial.

All the valuable heavy minerals come from the same source — the Klamath Mountains. During successive geological periods, the ocean repeatedly retreated and then advanced over the continental shelf, leading to increased sorting and higher concentrations of minerals on the shelf.

The third researcher involved is Curt Peterson. Their work is financed through the federal-state Sea Grant program.

Chromite deposits 5878 to be assessed

Both the Oregon coast and waters nearshore are known to contain deposits of chromite, the mineral source of chromium, but scientific data about how extensive these deposits are and their accessibility have not been collected.

Two Oregon State University (OSU) marine geologists have received a grant to collect this information.

The research is timely, said the principal researcher, because of renewed interest in developing domestic sources of chromium. LaVerne Kulm, oceanography professor, noted that the United States currently imports all its chromium, much of it from South Africa and the Soviet Union.

The \$35,000 research grant has been awarded by the Oregon Department of Geology and Mineral Industries to Kulm and Curt Peterson, an oceanography research associate. Kulm, who directed OSU research into offshore mineral deposits on the continental shelf in the late 1960s and early 1970s, said that the main purpose of the new research is to inventory all the existing geological and geophysical data on heavy mineral deposits in the beaches, beach terraces and offshore continental shelf, from northern California to southern Washington.

Heavy minerals include not only chromite but ilmenite, the mineral source of titanium, another important industrial metal.

The emphasis of the inventory would be on data concerning Oregon, said Kulm. "We'll be looking not only at published reports, but sediment samples and technical data to help identify where the most abundant chromite deposits likely will be found."

Useful Minerals in Black Sands of the Pacific Slope

by D T Day and R H Richards.

Min. Res. of U S, 1905,

P 393 B Hammond, Ore.	Ma 72, Ch 7, Ga 18, Ol 314, Mo 1, <u>Zi 47</u> , Qu 1193, Un 344, Natural beach sand.
P 727 Coos Bay, Ore.	Ma 64, Ch 470, Il 288, Ga 200, <u>Zi 54</u> , Qu 808, Un 58, Natural beach sand.
P 274 A Yaquina Bay	Ma 124, Ch 106, Il 540, Ga 632, <u>Zi 84</u> , Qu 300, Un 212, Natural sand.
P 274 A do	Ma 122, Ch 128, Il 572, Ga 516, <u>Zi 78</u> , Qu 256, Un 330, Natural sand.
P 274 B do	Ma 86, Ch 60, Il 546, Ga 506, <u>Zi 48</u> , Qu 478, Un 276, Natural sand.
P 732 A Newport	Ma 160, Ch 136, Il 662, Ga 484, <u>Zi 106</u> , Qu 60, Un 394, Natural sand.
P 732 C do	Ma 42, Ch 58, Il 192, Ga 132, <u>Zi 38</u> , Qu 876, Un 664, Natural sand.
P 99 Crescent City	Ma 480, Ch 210, Ga 503, Ol 574, Mon 56, <u>Zi 44</u> , Qu 133, Natural sand.
R 3994 Trinidad, Cal.	Ma 360 , Ch 620, <u>Zi 80</u> , Un 940, Beach sand.

The Highest percentages of quartz were found in samples:

From Clatsop County beaches around Astoria, ~~Clatsop County~~ Seaside, Warrenton, Gearhart, Hammond, Ft, Stevens, Carnahan Station, Morrison, Clatsop Spit and Elk Creek.
 From South Fork of Coquille River.
 From Randolph District Beach sand.
 From Marshfield,
 From Bullards:
 From Whiskey Run.
 From Port Orford.
 From ~~Clatsop County~~ Portland ?
 From ~~Newport~~ River sands at Hood River.

The highest percentages of Olivine were found in samples :-
 From sands on northern Oregon Beaches from Astoria to Coos Bay.

The Highest percentages of Garnet were found in the sands from Hammond, and the Coos County beaches, and Port Orford Beach.

Investigations of Zirconium by J W Marden and M N Rich, U S Bu Min Bull 18

Sands from Pablo Beach, Florida. Chem. Analysis of Concentrate.

ZrSiO ₄	60%	A screen analysis of the original sand is:			
Fe ₂ O ₃	.5 to 1	plus	65 mesh	0.7%	because of the fineness
Al ₂ O ₃	not determined	"	80 "	2.4	of the sand grains it
TiO ₂	16	"	100 "	25.2	is suggested that atable
Free SiO ₂	20	"	150 "	58.5	similar to the Deister-
		"	200 "	9.7	Overstrom sliming table
		minus	200 "	2.6	should give good results

See Meyer, H. C. Uncommon Ores and Metals; E & M J v 107, Jan 11, 1919.

Pratt, J.H. ~~Mineralogical~~ Zircon, ~~Monazite~~ and other minerals used in the production of chemical compounds employed in the manufacture of lighting apparatus. N. Carolina Geological and Economical Survey, Bull No 25, 1916.

Schallar, W F, U S Min Res 1916 pt 2, Zirconium and rare earth minerals.
 Sterrett, D. B, do 1908, 1910 -11. Monazite and Zircon.

See Analytical methods for certain metals, by R B Moore, S C Lind, J W Marden, J P Bonardi, C W Davis and J E Conley; U S Bu Min Bull 21 Experimental production of alloy steels, by H W Gillett and E L Mack, U S Bu Min Bull 199

Zirconium, U S Bu Min Inf. Circ. 6455, 6456, 6457 and 6465. Venable, F P; Zirconium and its compounds; Am Chem Soc Mon Ser, The Chemical Catalog Co Inc, N Y 1922. De Boer, J H, Zirconium: Foote-Prints on the rare metals and unusual ores, vol 3 no 2, Foote Mineral Co., Philadelphia, pa. 1930.

Zirconium; Ind Eng Chem Vol 19 no 11, Am Chem Soc, Nov 1927

Mineral Foote-Notes, July-Aug 1918; Zirconia as a refractory. Do Vol 3 no 1, 1930, Zirconia.

Watson T and Hess F L, Properties, occurrences and uses of Zirconium, Min. Eng World, vol 37, Jul 6 to Dec 28, 1912, #

Mertens H C, Beach deposits of Ilmenite, Zircon and Rutile in Florida Nineteenth Ann Rept, Florida State Geol Survey, 1926-27, The State Geol Surv 1928.

Mineral Foote-Notes vol 2 no 7, Jul-Aug 1918. Bu Min Inf Circ 6455 contains list of importers, producers and dealers.

do 6456 lists and describes foreign and domestic occurrences

Electromagnetic and electrostatic separation and tabling combined in sand separation methods of concentration

In the Brazilian sand deposits electromagnetic separators were used to remove 1st ilmenite, 2nd zircon, 3rd monazite

THE FLOTATION OF CHROMITE
FROM ILMENITE BEARING OREGON BEACH SANDS

Ore Characteristics - These types of ore were tested: (1) A mixture of Florence dune sand with ilmenite and chromite concentrates (produced by electrostatic separation of beach sand). Approximately equal amounts of chromite and ilmenite concentrates were added to the mix; (2) Crude black sand from the Pioneer mine tailings; and (3) Sample of sand brought in by Mr. Nixon.

Ore No. 1 was used in the preliminary tests because the high percentage of ilmenite present made it easy to determine by microscopic examination if the chromite was being floated preferentially.

Ore No. 2 was used to further substantiate what appeared to be the correct procedure for treating the beach sands.

Ore No. 3 was used on the final tests because it was considered a more nearly representative sample of the beach sands which may be treated commercially.

Nature of Problem - To produce an ilmenite free chromite concentrate. Ilmenite tends to float with the same reagents as chromite, consequently, the chief phase of the problem was the flotation of chromite in preference to ilmenite.

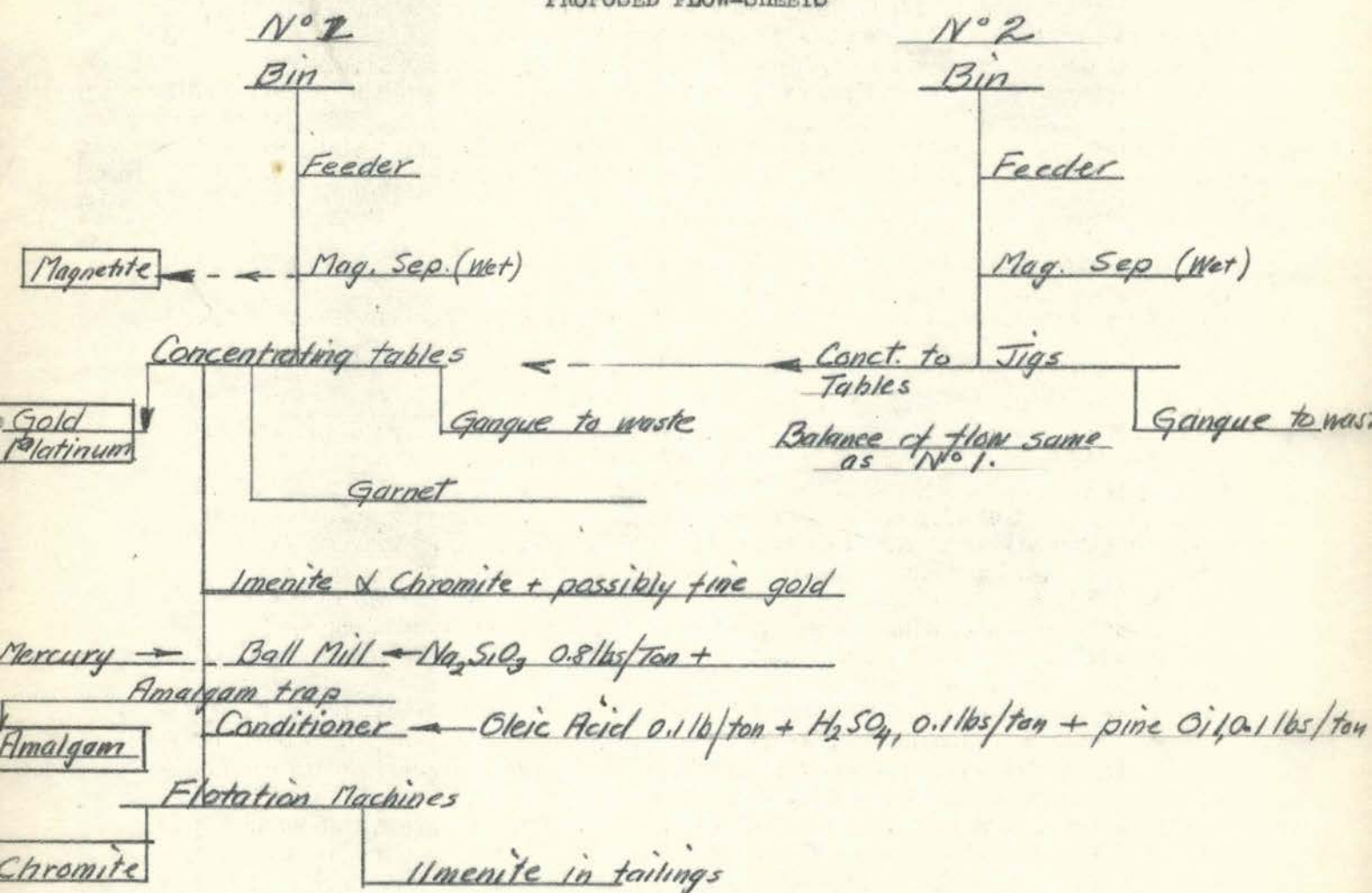
Description of Tests - The ore was split up into 500-gram portions. Each portion was ground with 250 c.c. of water for 20 minutes in a small laboratory rod mill. The ground product was floated in a small laboratory G. E. flotation machine. The length of flotation period was governed by the appearance of the froth. Flotation was stopped when it was apparent that no further useful separation was possible. The rougher concentrate was cleaned and the cleaner tails added to the rougher tails.

Reagents used were sodium silicate, sulphuric acid, oleic acid, sodium oleate, pine oil and X-1.

Sodium silicate was used to inhibit slime and gangue. It appeared to have a very beneficial affect on the froth, producing a clear brittle bubble which became heavily mineralized on the addition of a collecting agent such as oleic acid and sodium oleate. The optimum amount of Na_2SiO_3 seems to be approximately 0.8 lbs. per ton of ore. However, it was found that the effects of an excess of sodium silicate could be modified by the use of sulphuric acid. In fact, test work indicated that the best procedure involved grinding the ore in a slight excess of Na_2SiO_3 or, in other words, the best procedure involved grinding the ore in sufficient sodium silicate to insure a very brittle clear bubble which would not produce sufficient froth, and then adding sulphuric acid instead of frothing oils until sufficient froth was produced to insure flotation. This procedure - that

of balancing sodium silicate and sulphuric acid - to obtain a satisfactory froth with minimum amounts of frothing and collecting reagents seems to offer the best possibilities for separating chromite from ilmenite. Both minerals float with the same reagents, but may be selectively floated by balancing with sodium silicate and H_2SO_4 . Once the proper balance of these two reagents is obtained, very small amounts of collecting reagents are necessary. Selective action between chromite and ilmenite seems to depend on a paucity of reagents. If the pulp is not properly conditioned with a proper balance of sodium silicate and sulphuric acid, a greater amount of reagent is required to insure flotation and this larger amount is not selective in action.

PROPOSED FLOW-SHEETS



A concentrate produced using the reagents and amounts shown above appeared satisfactory. This sample of chromite concentrate has been submitted to the Grants Pass laboratory. If a satisfactory grade of chromite has been attained, further work on more of a quantitative basis is indicated.

James A. Adams

ESTIMATED COST OF ELECTROSTATIC SEPARATION

(H.B. Johnson: Electrostatic Separation. E & M D'38 P. 44

Assumed:

Plant operates 24 hours per day, 300 days per year
 Supervision, per hour \$0.75
 Power, per kw-hr. 0.02
 Fixed charges, 10% of installed value.

Tons per hour	5	25	50
Tons per year	36,000	180,000	360,000
Separating equipment installed	\$9,000	\$39,700	\$79,400
Drying equipment installed (Double-shell indirect-heat)	\$10,000	\$22,500	\$40,000
Charges:	per ton	per ton	per ton
Fixed (Amortization)	\$0.025	\$0.022	\$0.022
Power	.012	.006	.004
Supervision	.150	.030	.015
Repairs, supplies, maintenance etc.	.007	.007	.007
Total Separating Cost per ton	\$0.194	\$0.065	\$0.048
Fixed (Amortization)	\$0.042	\$0.019	\$0.017
Operating expenses	.304	.144	.093
Total Drying Cost per ton	\$0.346	\$0.163	\$0.110
TOTAL OVERALL COST	\$0.540	\$0.228	\$0.158

MAGNETIC CONCENTRATION COSTS, (IC 6624 P. 2-4) Witherbee, Sherman & Co. Mineville, N.Y.

Operating in 1930 at hourly capacity of 100 tons

Charges:

Fixed and superintendence	\$0.069
Power	.070
Transporting, elevating	.194
Drying (Shaft furnace)	.061
TOTAL ACTUAL OVERALL COST	\$0.394

TITANIUM

Occurrence and Geology

- Rutile - known large deposits are in pegmatites or in/very closely related the basic rocks with apatite and albite as common associates.
- Ilmenite - Sometimes found in quartz veins. In large deposits it most commonly occurs along cleavage planes of magnetite and can be separated magnetically. Pure ilmenite in place is known in minable bodies only in nelsonite. Most of ilmenite is found in schists and gneisses, andesites and other lavas, gabbros and basic granular rocks, in small dispersed grains or plates.

Economic Distribution - United States

Roseland, Virginia - concentrated from pegmatite
Magnet Cove, Hot Springs County, Arkansas

Buyers - Titanium

American Rubber Co., Park Ave. &
Wm. J. Auw, 2050 Galbreath Road, Pasadena

Rutile

National Tile Co. Inc., Anderson, Indiana
Foote Mineral Co., 1610 Summer St., Philadelphia

Ilmenite

Glidden Co., 11100 Glidden Ave., Cleveland, Ohio

Uses:

1. Used little as alloy in high speed steel in place of vanadium
2. As Ferrocenone titanium (made in the electric furnace)
 - (a) 15 to 18% Ti, 6 to 8% C. \$137.50 per ton
 - (b) 18 to 20% Ti, 4 to 5% C. \$142.50 " "
 - (c) With less carbon and some silicon 20¢ to 25¢ per pound.
3. Addition of 5 to 7 times as much titanium as carbon in high chromium steels makes steels easier rolled hot, prevents air hardening, softer and more ductile after rolling.
4. Titanium white TiO_2 pigments (from ilmenite—31.6 Ti, 31.6 Fe, 36.8)—Is a growing business. Rutile best source, difficult to manufacture from high iron minerals.
5. Titanium tetrachloride—smoke clouds in war and skywriting—by product of titanium white—manufactured from ilmenite
6. Rutile—used as welding rod coating.

Production:

Most ilmenite imported from India. Domestic rutile production exceeds imports. Australia leading foreign source of rutile.

Price:

Ilmenite Atlantic seaboard, 45 to 55% TiO_2 \$10 to \$12 per ton.
Rutile (94% concentrate) 10¢ per lb. Concentrates accepted run from 88% up.
Price obtained will probably be arrived at by bargaining.

Ore Minerals - Ilmenite and Rutile. The present E. & M. J. price quoted is \$5.00 per lb. for 98% pure metallic Titanium.

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STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

329 S. W. OAK STREET
PORTLAND, OREGON

April 20, 1940

STATE ASSAY LABORATORIES
402 E. I ST., GRANTS PASS
J. E. MORRISON
MINING GEOLOGIST
ALBERT A. LEWIS
ANALYST
2102 COURT ST., BAKER
JOHN ELIOT ALLEN
FIELD GEOLOGIST
LESLIE L. MOTZ
ANALYST

Replies should be
addressed c/o State
Assay Laboratory
400 E. I Street
Grants Pass, Oregon

Mr. Leslie L. Motz, Metallurgical Chemist
State Department of Geology and
Mineral Industries
329 S. W. Oak Street
Portland, Oregon

Following are the results of chromium determinations
made on ten samples of beach sand:

<u>Office number</u>	<u>Sample</u>	<u>Chromic Oxide Percent</u>
AG 474	AP 16, #3	20.5
AG 514	AP 18, #5A	20.8
AG 515	AP 19, #6	3.7
AG 516	AP 22, #8A	0.1
AG 517	AP 23, #8B	2.3
AG 518	AP 24, #8C	2.4
AG 519	AP 25, #9A	25.6
AG 520	AP 26, #9B	12.4
AG 521	AP 33, D5	26.6
AG 522	AP 34, D6	27.6

Signed. *Albert A. Lewis*
Albert A. Lewis
Analyst

For Motz

STATE DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

ASSAY REPORT

Office Number AG 313 & 314

Grants Pass, Oregon

~~XXXXXX~~

March 21 1940

Sample submitted by Leslie L. Motz

329 S. W. Oak St., Portland, Ore.

Sample description Two samples of fine beach sand.

The assay results given below are made without charge as provided by Chapter 176, Section 10, Oregon Laws 1937, the sender having complied with the provisions thereof.

NOTICE: The assay results given below are from a sample furnished by the above named person. This department had no part in the taking of the sample and assumes no responsibility, other than the accuracy of the assay of the material as furnished it by the sender.

Sample Number	GOLD		SILVER		Chromic oxide		Iron		Total Value
	Ounces per ton	Value	Ounces per ton	Value	Percent	Value	Percent	Value	
AP 10	12.4	11.6			0.7	.28	6.4		
AP 11		+65			1.0	.78	9.7		

Market Quotations:

Gold \$ per oz.
Silver \$ per oz.
 \$ per oz.
 \$ per oz.

STATE ASSAY LABORATORY

Albert A. Lewis
Assayer

RECEIVED
MAR 22 1940

STATE DEPT. OF GEOLOGY
& MINERAL IND.



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PRESIDENTNEWCOMB CARLTON
CHAIRMAN OF THE BOARDJ. C. WILLEVER
FIRST VICE-PRESIDENT

SYMBOLS

DL=Day Letter

NL=Night Letter

LC=Deferred Cable

NLT=Cable Night Letter

Ship Radiogram

The filing time shown in the date line on telegrams and day letters is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination.

,PZ15 41 DL COLLECT XC=GRANTSPASS ORG 4 1057A

EARL K NIXON=

1940 APR 4 AM 11 03

STATE DEPT OF GEOLOGY AND MINERAL INDUSTRIES

329 SOUTHWEST OAK ST PORTLAND OR=

CHROMIC OXIDE CONTENT OF SAND SAMPLES CORRECT AS ORIGINALLY
REPORTED. FOLLOWING ARE RESULTS OF CHECK ASSAYS: AG 166 12.3
PERCENT AG 167 3.4 PERCENT AP10 0.4 PERCENT AP11 1.0 PERCENT
AP 14 0.7 PERCENT AP 14 0.7 PERCENT=

ALBERT A LEWIS.

RECEIVED
APR 4 1940STATE DEPT OF GEOLOGY
& MINERAL INDS.

#16

ESTABLISHED 1892

LERCH BROTHERS INCORPORATED

LABORATORIES

BIWABIK
ELCOR
VIRGINIA
ALBANY LOC.
HIBBING
MAHONING LOC.

THE IRON ORE CHEMISTS

LABORATORIES ON THE MESABA AND CUYUNA
IRON ORE RANGES IN MINNESOTA

GENERAL OFFICES
CORNER N. ST. LOUIS AVE.
AND GRANT STREET

HIBBING, MINNESOTA
March 21, 1940

LABORATORIES

KEEWATIN
NASHWAUK
COOLEY
CALUMET
BOVEY
CROSBY

RECEIVED
MAR 25 1940

STATE DEPT OF GEOLOGY
& MINERAL INDS.

Mr. Earl K. Nixon
State Dept. of Geology
and Mineral Industries
329 S.W. Oak Street
Portland, Oregon

Dear Sir:

The result on the assay of sample as submitted
to us is as follows:

Phosphorous .007%

Enclosed you will find a bill for services.
Thank you for giving us the opportunity to serve you.

Very truly yours,

LERCH BROTHERS INCORPORATED

By

Sander G. Lawrence
Asst. Gen. Mgr.

Sander G. Lawrence:AJ

Enc.

STATE DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

ASSAY REPORT

Office Number _____

Grants Pass, Oregon
Baker, Oregon

Mar. 16, 1934

Sample submitted by Portland Office, Dept. Geology & Mineral Industries.

Sample description AP 8 Sand chiefly silica.

AP 9 Chiefly chromite and magnetite.

The assay results given below are made without charge as provided by Chapter 176, Section 10, Oregon Laws 1937, the sender having complied with the provisions thereof.

NOTICE: The assay results given below are from a sample furnished by the above named person. This department had no part in the taking of the sample and assumes no responsibility, other than the accuracy of the assay of the material as furnished it by the sender.

SILICA

Sample Number	GOLD		SILVER		CHROMIUM		IRON		Total Value
	Ounces per ton	Value	Ounces per ton	Value	Percent	Value	Percent	Value	
AP 8			percent 88		15.4		40.8		
			<i>Pure</i>			<i>9B</i>	<i>Magnetite</i>		

Market Quotations:

Gold per oz.
Silver per oz.
per oz.
per oz.

STATE ASSAY LABORATORY

Hugh L. Lancaster
Assayer

STATE DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

AG 273

AG 274

AG 275

AG 276

ASSAY REPORT

Office Number

Grants Pass, Oregon

Baker, Oregon

March 12 1930

Sample submitted by Leslie L. Motz

329 S. W. Oak Street, Portland, O

Sample description Four samples of sand. Duplicate assays were made on each sample.

The assay results given below are made without charge as provided by Chapter 176, Section 10, Oregon Laws 1937, the sender having complied with the provisions thereof.

NOTICE: The assay results given below are from a sample furnished by the above named person. This department had no part in the taking of the sample and assumes no responsibility, other than the accuracy of the assay of the material as furnished it by the sender.

9A

Sample Number	GOLD		SILVER		Chromic oxide				Total Value
	Ounces per ton	Value	Ounces per ton	Value	Percent	Value	Percent	Value	
AP 3	-35 + 48		Bottle	3	3.6				
AP 3			3.7						
AP 4	-48 + 65		2		21.7				
AP 4					21.8				
AP 5	-65		1		36.0				
AP 5					35.9				

Market Quotations:

Gold per oz.
Silver per oz.
per oz.
per oz.

STATE ASSAY LABORATORY

Albert C. Lewis
Assayer

AP 6 -48 + 65 Conc. #4 36.3 36.1
AP 6 35.9

55% iron

#2 88% SiO₂

9B. May 15.4 Cr.
40.8 Fe



STATE DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

ASSAY REPORT

Office Number _____

Grants Pass, Oregon
Baker, Oregon

2/27/40

193

Sample submitted by Leslie L. Motz, Portland Office

Sample description AP2 Original black sand.

The assay results given below are made without charge as provided by Chapter 176, Section 10, Oregon Laws 1937, the sender having complied with the provisions thereof.

NOTICE: The assay results given below are from a sample furnished by the above named person. This department had no part in the taking of the sample and assumes no responsibility, other than the accuracy of the assay of the material as furnished it by the sender.

Sample Number	GOLD		SILVER		PHOSPHORUS				Total Value
	Ounces per ton	Value	Ounces per ton	Value	Percent	Value	Percent	Value	
AP-2					0.12				

Market Quotations:

Gold	\$	per oz.
Silver	\$	per oz.
	\$	per oz.
	\$	per oz.

STATE ASSAY LABORATORY

Hugh K. Lancaster
Assayer

February 15, 1940

Mr. Dick Wilmot
Sutherland
Oregon

Dear Mr. Wilmot:

Before Mr. Nixon's departure for New York he gave me the correspondence which he had had with you with regard to electrostatic chromite concentrate. I have been doing some work along this line, but have not produced as clean a concentrate as we desire. At the present time the best concentrate assays around 40% chromic oxide. If you would be interested in some of this concentrated material, I would be glad to send it to you, but it is not a product which we desire.

We have been able to take this electrostatic concentrate and by panning, getting a higher grade product.

I do not know whether or not the ilmenite has been taken from the sands, but I imagine so because the titanium content is very low in the order of .48%.

I believe the answer of this problem lies in a combination of magnetic electrostatic and either air or water classification. A man here in Portland has a separator based upon air as the medium, and I shall expect to see it in operation very shortly.

Of course, with this meager information I have no idea at all what the cost will be. I think that the operation will stand operating costs of better than a dollar, as all products are considered on the credit side.

I shall be very glad to advise you of any success we may have and I would appreciate any suggestions on your part.

Very truly yours,

Leslie L. Motz
Metallurgical Chemist

LLM:HE

RECEIVED
FEB 15 1940

STATE DEPT. OF GEOLOGY
& MINERAL INDS.

Feb 14/40
Luthulir

Dear Mr Motz

Mr Nixon has
told me that you were
working on the
electrostatic separation
of the beach sands.

This sounds like the
simplest and best
way and the cheapest.

If it is permitted
I would like to
know what luck

you are having in
~~the~~ cleaning the
ilmeneite from the
sands as I understand
that this is the determining
factor in commercial
operation. It seems
to me that there is
a possibility of attaining
the concentration by
selective sinking. If
the latter would work
it would I think require
a long study for which
I would have to
build the apparatus

so I have been rather slow to start. But there is also the factor of cost. The concentration of the sands will have to be done by a simiportable plant of low first cost wherein the ^{mill} total mining and operating costs are not in excess 75¢ and will probably have to be less than 50¢ per ton

Do you think electrostatic operation will meet these requirements? + clean separation

Dick Wilmot

February 9, 1940

Mr. Richard Wilmot
Sutherlin, Oregon

Dear Dick:

Thanks kindly for your letter of February 4th. We haven't at the moment more than about 2 pounds of the most representative electrostatic separation concentrate, and I am taking part of that East with me tomorrow for discussions with the U. S. Bureau of Mines in Washington. However, Mr. Motz has some electrostatic apparatus set up here in Portland and is doing work on a large number of big samples we took in the coastal area last week. I think he will be in a position to forward to Mr. Hoffer a sample or two within the next week or ten days, and I am asking him to do so. The samples will not be awfully high-grade although they will probably run better than 40% chromic oxide.

Best wishes to yourself and Pop.

Sincerely yours,

EKN:vm

Director

The BROADMOOR

A HOTEL OF DISTINCTION
SUTTER at GOUGH • SAN FRANCISCO

RECEIVED
FEB 9 1940

STATE DEPT OF GEOLOGY
& MINERAL INDS.

Feb 4/40

Sutherland

Dear Mr Nixon

Quite recently in Los Angeles I saw a friend whom I have known many years. He is an inventor who is both competent and reliable. It seems that an associate of his whom I also know has developed a process for the reduction of chrome that is about $\frac{2}{3}$ cheaper than present methods. The process requires cheap electric power and a relatively small quantity of natural gas. At the same time they have developed a process of ^{briquetting} that appears to be both cheap and possible.

I told him of your work on the black sands and he was immensely interested.

If the invention and the supply can be brought together there should be a real possibility of an Oregon chrome industry. The results would depend on the tonnage available — the costs and the purity of the concentrates. The last consideration is especially important.

Would it be possible for you to send several representative samples of say 2 # apiece to Mr Howard Hoffer 1011 Pine St. Santa Monica Calif.? If there are any costs please send me a bill.

Yours
Richard Wilmot

(Sent 10-12-6)

BLACK SANDS

Although "black sands" do not constitute a true mineral commodity in the commonly accepted sense, they are treated separately here because of their geologic propinquity. The black sands are composed largely of grains and crystals, usually carefully graded both as to size and specific gravity by running water or the work of the waves. Minerals included in the sands are: magnetite, chromite, zircon, rutile, olivine, pyroxene, ilmenite, garnet, epidote, quartz, and minute quantities of gold and platinum.

Utilization of the various minerals included in the black sands has come a long way since they were first mined solely for gold 125 years ago. Chromite finds its principal use as a ferroalloy which imparts heat and corrosion resistance plus hardness and strength to steels. Minor uses include various chemicals, pigments, and the familiar chrome plating on various metal surfaces. Zircon contains the element zirconium, and rutile and ilmenite are ores of titanium. Both zirconium and titanium are members of the "space-age metals" family. Zirconium, because of its unique property of providing a metallic envelope having both high corrosion resistance and very low absorption of neutrons, is widely used in atomic reactors for holding the uranium rods. Titanium metal has only 60 percent of the weight of steel but possesses unusual strength at elevated temperatures. These qualities make it useful in space craft and supersonic aircraft. Titanium also has good chemical resistance to chlorine and many acids. Magnetite, an iron oxide mineral, is commonly used as an iron ore. Minor amounts go into high density concretes for ship ballasting and atomic shielding in reactors. Some magnetite has been sold to roofing manufacturers. Garnet, in the sizes available in the coastal black

(Sept 10 - 12-6)

BLACK SANDS

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sands, has found limited usefulness. Small quantities of garnet sand have been sold for sand blasting and as an abrasive in dimension stone quarry gang and wire saws. Although studies have been made over the years to find markets for the quartz grains which accompany the black sands, no success has been reported. Most of the quartz grains have been freed from any enclosing matrix and theoretically should be composed of practically pure silicon dioxide. Unfortunately many of the grains have cracks or fractures which contain iron oxide films. The iron cannot be removed by any simple washing or acid leaching treatment, thus precluding the use of the quartz for glass making. No other markets have been considered.

Other associated black sand minerals include olivine, epidote, and pyroxene. Although these components have no commercial application at the present time, any beneficiation of the other salable black sand fractions would in effect make at least a rough concentrate of these minerals. Future changes in technology could conceivably create markets for them.

The black sands found along the southwestern Oregon coast have attracted attention since 1852 when gold was panned from the mouth of Whisky Run about six miles north of the mouth of the Coquille River in Coos County. Although the sands were worked originally solely for their gold content, the presence of platinum associated with it was eventually discovered, and the recovery of the silvery grains, which hitherto had been regarded as waste material, was started. It was not until 1926, however, that any serious attention was given to the associated "heavy blacks" in the sands along the active coastal beaches and the elevated terraces immediately shoreward from them. No exploitation of the deposits occurred until World War II when the demand for chromite made it economically feasible to concentrate the richer portions

of some of the terrace deposits. A total of 46,500 tons of semi-finished concentrates left over from the war-time activity were subsequently upgraded, and five fractions containing chromite, magnetite, garnet, ilmenite, and zircon were produced.

Despite the relatively small production of black sands from southwestern Oregon there has been a long history of investigation of the deposits. Originally reported on by Diller in 1901 as part of the Coos Bay Folio of the U.S. Geological Survey Geologic Atlas, the deposits have been examined by private, state, and federal organizations. A selected bibliography of the more significant works appears at the end of this section.

Heavy detrital minerals, eroded from the Klamath-Siskiyou Mountains of Mesozoic age, have been transported westward to elevated marine terraces which mark former shorelines. The Pleistocene terraces now stand as much as 1500 feet above present sea level and extend shoreward as far as four miles from the coastline. Following the elevation of the terraces the sediments were carried farther west to the advancing coastline. Pleistocene fluctuations in sea level shifted the shoreline considerably, and unknown quantities of black sand were deposited at considerable distances seaward from the present beaches. Contrary to popular conception, the "black sand" deposits are not very black, nor are they uniform over large areas. Characteristically the sands are somewhat darker in color than the buff-colored dunes in the area, the color depending upon the relative concentration of the heavy black minerals. The vagaries of wind and wave have determined the size and shape of the black sand deposits. Many of the concentrations are highly irregular in shape, although lenticular masses are perhaps the most common form. In some areas sands are found in almost perfectly horizontal bands of various thickness.

The deposits are found by drilling into the weakly cemented or simply compacted terrace sands. Some lenses occur at or near the surface, others have been found at depths of 60 feet or more.

Interest in exploiting Oregon's black sands is tied almost completely to the need during periods of national emergency for chromite. Currently the United States produces none of this strategic commodity. World production in 1965 totalled nearly 5.4 million short tons. The five principal producing countries are:

<u>Country</u>	<u>Short tons</u>
U.S.S.R.	1,565,000
Republic of South Africa	1,038,498
Turkey	625,078
Southern Rhodesia	624,500
Philippines	611,288

Source: U.S. Bur. Mines Minerals Yearbook, 1965.

During periods of national emergency Oregon has been an important producer of chromite. The bulk of production has come in the past from hard rock mines rather than from the coastal sands, however. Domestic production is limited to the five states: California, Oregon, Montana, Alaska, and Texas. Chromiferous sands have only been mined in Oregon.

Black sand deposits in Oregon are found at numerous places along the coast (see map). The greatest amount of attention has been directed to the terraces lying between Coos Bay and the mouth of the Coquille River in Coos County, an area roughly 5 miles wide and 25 miles long. The area is gently rolling and covered with a dense growth of brush or second growth timber. Ownership is largely privately held land partly under cultivation or lands which have been logged off but are currently idle for the most part.

As has been mentioned, the deposits occur in unconsolidated or poorly cemented Pleistocene terrace deposits. Heavy rainfall plus rank vegetative growth help to promptly obscure the pits once they are abandoned. Black sands on the active beaches of the area present a dual problem to the prospective miner. Most of the "wet sand" areas have been reserved for public use by the state. Currently an additional and adjoining strip of "dry sand" is being surveyed by the state for eventual inclusion in the public use area. Certain small sections of the active beach are privately owned and presumably could be leased or purchased. Regardless of the status of the land and the possibilities for mining from a legal standpoint there is an overriding difficulty in the continual hazards of wind, wave, and tide along the littoral. The destructive effects of storm winds and wind-driven waves are well known. Less well appreciated are the recurring changes in the sand deposits caused by normal wave and wind action from day to day. These changes make it almost impossible to plan an orderly and efficient mining program. Numerous attempts to recover black sands from the active beaches have ended in failure.

Other areas that have been considered for exploitation include: (1) Hammond deposit in Clatsop County, where a small but fairly well concentrated deposit occurs on the south bank of the Columbia River estuary. There has been no production. (2) Clatsop Spit. The Bunker Hill Company examined the property in early 1963 and put down a series of holes to determine the iron content. The project was terminated after 34 holes, ranging in depth from 40 to 86 feet, were drilled. The top 10 feet contained the highest concentrations of iron but the average content was only 22.6 pounds per ton. The company had 2000 acres under lease from Clatsop County, the State of Oregon, and the federal government. (3) Newport. A small amount of gold and platinum was

recovered many years ago from the active beach. Little if any activity has been conducted recently. (4) Cape Blanco-Port Orford. This area ranks second to the deposits lying north of Bandon in the production of gold and platinum. Most of the recovery has been from the active beaches, with lesser amounts coming from elevated terraces not far from the coast. Aside from one or two small beach placers there has been little activity since the middle 1930's. (5) Ophir-Gold Beach. The active beaches near the mouth of the Rogue River have produced gold but very little platinum over the years. Most of the placering was done years ago when rich concentrations of gold were worked along the active beach. During World War II several attempts were made to concentrate chromite in the black sands but they were not successful.

Offshore black sand deposits along the southern Oregon coast present quite a different picture. Studies by the U.S. Geological Survey and the U.S. Bureau of Mines got under way in 1966 to identify areas containing concentrations of heavy minerals. The amount of black sand together with gold and platinum that has been washed down from the Klamath-Siskiyou Mountains is probably very large. Whether or not the material has been concentrated sufficiently is not known. The near-shore waters along stretches of the southwestern Oregon coast are dotted with small islands, stacks, arches, and rocks which are exposed only at the lowest tides. Whether these have had a disruptive effect on the depositional pattern, and whether they will present a serious obstacle to any future offshore-based mining venture will have to be determined.

Potential reserves of onshore black sand in southwestern Oregon have not been adequately determined. Most of the investigations have been made during periods of national emergency and were directed primarily towards discovering

the most readily mined deposits. No comprehensive examination of the entire district has been conducted. The U.S. Geological Survey inaugurated an onshore test drilling program along the coast north of Bandon in 1966. Any peace-time exploitation of the deposits will depend on the use of all or nearly all of the various "heavy blacks." Changing markets and prices, coupled with mining and beneficiation costs will be the critical factors in determining the cut-off grade of the deposits, the tonnage available, and ultimately the feasibility of conducting the program.

Exploration of the potential black sand deposits can be done at relatively low cost. The area is accessible the year around, the climate is characterized by fairly heavy rainfall, and very little snow or sub-freezing weather. Drilling and trenching would require standard equipment for penetrating poorly consolidated sand. The Coos County deposits are located adjacent to rail, highway, and deep water transportation. The cities of Coos Bay, North Bend, Coquille, Bandon, Empire, and Charleston are located around the periphery of the area and can supply labor, materials, services, and supplies.

Bibliography

- Butler, G. M., and Mitchell, G. J., 1916, Preliminary survey of the geology and mineral resources of Curry County, Oregon: Oregon Bur. Mines and Geology, Mineral Resources of Oregon, vol. 2, no. 2.
- Cooper, W. S., 1967, Coastal sand dunes of Oregon and Washington: Geol. Soc. America Memoir 72.
- Dasher, J., Frass, F., and Gabriel, A., 1942, Mineral dressing of Oregon beach sands: U.S. Bur. Mines Rept. Inv. 3668.
- Day, D. T., and Richards, R. H., 1905, Black sands of the Pacific Slope: U.S. Geol. Survey Mineral Resources of the United States.
- Diller, J. S., 1901, Coos Bay Folio: U.S. Geol. Survey Atlas No. 73.
- _____, 1902, Topographic development of the Klamath Mountains: U.S. Geol. Survey Bull. 196.
- _____, 1903, Port Orford Folio: U.S. Geol. Survey Atlas No. 89.
- _____, 1914, Mineral resources of southwestern Oregon: U.S. Geol. Survey Bull. 546.
- Griggs, A. B., 1945, Chromite-bearing sands of the southern part of the coast of Oregon: U.S. Geol. Survey Bull. 945-E.
- Hornor, R. R., 1918, Notes on black-sand deposits of southern Oregon and northern California: U.S. Bur. Mines Tech. Paper 196.

Hundhausen, R. J., 1947, Chromite sand deposits in the Coos Bay area, Coos County, Oregon: U.S. Bur. Mines Rept. Inv. 4001.

Hunt, J. F., 1960, Beneficiation of southwest Oregon beach sands by high tension and magnetic dry processing: Am. Institute of Mining, Metallurgical, and Petroleum Engineers, Pac. Northwest Metals and Minerals Conference paper.

Kauffman, A. J., and Baber, K. D., 1956, Potential of heavy mineral bearing alluvial deposits in the Pacific Northwest: U.S. Bur. Mines Inf. Circ. 7767.

_____, and Holt, D. C., 1965, Zircon: A review, with emphasis on West Coast resources and Markets: U.S. Bur. Mines Inf. Circ. 8268.

Pardee, J. T., 1941, Beach placers of the Oregon coast: U.S. Geol. Survey Circ. 8.

Richards, L. C., 1960, Black sands of the southern Oregon coast: private report.

Twenhofel, W. H., 1943, Origin of the black sands of the coast of southwestern Oregon: State of Oregon Dept. Geology and Mineral Industries Bull. 24.

_____, 1946, Mineralogical and physical composition of the sands of the Oregon coast from Coos Bay to the mouth of the Columbia River: State of Oregon Dept. Geology and Mineral Industries Bull. 30.

6. Gold Beach-Ophir

BLACK SANDS

Map of Oregon showing county boundaries, major rivers, and cities. The map includes a scale bar from 0 to 150 miles and a coordinate grid. A box labeled "BLACK SANDS" is located in the Clatsop County area. Numbered circles 1 through 5 are placed at various locations: 1 near Astoria, 2 near Newport, 3 near Corvallis, 4 near Coquille, and 5 near Gold Beach. The map shows major rivers like the Columbia, Willamette, and Klamath, and cities such as Portland, Salem, Eugene, and Medford.

6. Gold Beach-Ophir

BLACK SANDS

Map of Oregon showing county boundaries, major rivers, and cities. The map includes a scale bar from 0 to 150 miles and a coordinate grid. Numbered circles 1 through 6 are placed at various locations: 1 near Astoria, 2 near Newport, 3 near Corvallis, 4 near Coquille, 5 near Grants Pass, and 6 near Gold Beach. The map shows major rivers like the Columbia, Willamette, and Klamath, and cities such as Portland, Salem, Eugene, and Medford. A box labeled 'BLACK SANDS' is located in the central part of the state, near the Willamette River.



6. Gold Beach-Ophir

BLACK SANDS

Black Sands

June 18, 1968

Mr. Chester Rooklidge
Westward Properties, Inc.
1618 S.W. First Avenue
Portland, Oregon 97201

Dear Mr. Rooklidge:

Here are some copies of various reports on "black sands" taken from our files. You will note on the sheet containing a short bibliography that there are references to other reports. These are somewhat lengthy and we would like to suggest that you might want to examine them in our library at your convenience.

A great deal of attention has been directed to the extraction of black sands from the sediments at the mouth of the Columbia. A few years ago the Bunker Hill Company leased considerable acreages in the Clatsop Spit area and did some exploration work. A summary of their drilling and sampling is included in the set of reports provided you. Currently another group is contemplating mining operations on the Washington side of the Columbia. The percentage of "heavy blacks" in the sands of the Lower Columbia is not only low but is constantly changing as wind and wave, flood periods, and low water all have their effect on the nature of the deposits. Since the sands lie mostly within the channel of the river and thus come under the jurisdiction of the Army Engineers and the U.S. Coast Guard, the problem of complying with regulations enforced by these agencies must be considered. A further problem is one of stream pollution and the destruction of habitat for waterfowl and marine and aquatic life.

In sharp contrast the black sands in the Coos Bay area are removed from the active beach, are readily accessible by paved highway, are located near several cities which can furnish labor and supplies, and transportation of concentrate can be effected by deep water, rail, or highway. The successful metallurgical treatment of the Coos Bay sands has been demonstrated by the plant operated by Pacific Northwest Alloys. The major problem has always been one of economics. Any successful operation will have to be conducted on a large scale to reduce mining and milling costs to a minimum

and markets must be found for as many of the co-products as possible. Neither of these conditions has been achieved in the past for one reason or another. The Pacific Northwest Alloys operation reworked the stockpile of semi-finished concentrate prepared during World War II and produced salable concentrates of chromite, magnetite, zircon, ilmenite, and rutile.

After you have had an opportunity to examine the various reports you may desire further information. Please feel free to call on us at any time.

Sincerely yours,

Ralph S. Mason
Mining Engineer

RSM:lk
Encl.

BLACK SAND

January 2, 1970

Mr. G. J. Orazem
Manager, Corporate Development
Lithium Corporation of America
Box 8
Bessemer City, North Carolina 28016

Dear Mr. Orazem:

Thank you for your inquiry concerning the black sand deposits of the southwestern coast.

Here are some tear sheets from our Bulletin 64 which summarize the coastal black sands. You will note there are several references to additional publications. Ownership of the beach sand properties could best be obtained from the county assessors of Coos and Curry Counties. The Coos County Courthouse is located at Coquille; the Curry County Courthouse at Gold Beach.

In quick summary, the onshore black sand deposits are characterized by highly irregular concentrations dispersed rather widely through some elevated beach terraces over a considerable area.

There are no particular metallurgical problems to the beneficiation and concentration of the various fractions. The main difficulty has been, and still is, the economic problem of first locating and then extracting the rather small pods of black sand from the vast amount of waste material.

You would have no difficulty in obtaining any number of samples from the area since there are excellent roads traversing it and the weather is rarely a factor. If surface samples were all that would be required there is only a small amount of overburden to deal with. If samples at depth were needed, they could be obtained with simple hand or power auger equipment.

Sincerely yours,

Ralph S. Mason
Mining Engineer

RSM:lk
Encl.

LITHIUM CORPORATION OF AMERICA

A SUBSIDIARY OF GULF RESOURCES & CHEMICAL CORPORATION
BESSEMER CITY, NORTH CAROLINA 28016 • (704) 629-2282



December 19, 1969

Department of Geological & Mineral Industries
State of Oregon
Salem, Oregon 97301

Gentlemen:

During World War II there was considerable interest in the Oregon beach sands. Lithium Corporation of America has recently developed beneficiation techniques which may be applicable to these sands. We are writing you for information, if available, on the following:

- A. General information on the beach sands with special reference to past beneficiation operations and/or exploration to define the deposits. *Jack Hunt*

We have the U.S. Bureau of Mines Bulletin RI 4001.

- B. Where could we obtain information on the ownership of the beach sand properties which have been defined by the previous exploration work.
- C. How readily could a 50 pound sample of the beach sands be obtained.

Thank you for any assistance you may be able to give on this subject.

Very truly yours,

LITHIUM CORPORATION OF AMERICA

G. J. Orazem
G. J. Orazem

Manager, Corporate Development

GJO:gw

RECEIVED
DEC 23 1969

DEPT. OF GEOLOGY
MINERAL IND.

February 18, 1975

The Honorable Norman Howard
Oregon State Senate
State Capitol
Salem, Oregon

Dear Senator Howard:

Here is some background information on the occurrence of Oregon garnet which you requested the other day.

The so-called "black sands" found along the southwestern coastal zone probably contain the largest readily available reserve of garnet in the state. The "black sands" are actually a widely varying assemblage of heavy, black minerals such as chromite, magnetite, olivine, pyroxene, ilmenite, rutile, zircon, garnet, epidote, and a few others, plus lighter-weight minerals such as quartz, feldspar, and mica. The percentage of garnet in the "black sand" lenses or horizons ranges from about 10 percent to as much as 28 percent. It should be pointed out, however, that by far the largest proportion of the coastal terrace sands is composed of quartz and feldspar and the "black sands" represent only a very small part of the total mass.

The terrace deposits which contain the black sand lenses extend for a considerable distance along the Coos and Curry County coast. The principal deposits are found between Cape Arago and the town of Port Orford and in the South Slough area south of Charleston. Although black sands are found on the active beaches, the minable reserves are restricted to the series of elevated marine terraces which lie several miles inland and several hundred feet above sea level. Ownership of the terraces is an intricate mixture of federal, county, state, private and other. Much of the area is cut-over land or brush and pasture, with private homes and farms scattered widely in various places. Access is generally excellent to good and once started, operations could be conducted on a year-round basis.

The Honorable Norman Howard

Page 2

February 18, 1975

The principal obstacle to exploitation of the black sands is an economic one. Presently the value of the various constituents is too low to justify their production. The low grade of the deposit, combined with the erratic nature of the concentrated portions poses some very real materials-handling problems with respect to costs. No metallurgical problem exists in the beneficiation of the black sands. Environmental considerations should be easily satisfied. The gently rolling nature of the land, high rainfall, and equable climate would make reclamation inexpensive and rapid. Much of the land is presently lying idle, or is not being used to its fullest potential.

Despite the availability of the heavy black minerals, many of which have some economic value, very little has been done with the resource. During World War II a few thousands of tons of chromite were concentrated from a deposit just north of Bullards. After the war this rough concentrate was reworked and chromite, magnetite, garnet, rutile, and ilmenite were segregated. Only the chromite was actually economic, the other fractions being almost given away to get rid of them. Very small amounts of gold and platinum are associated with the "black sands" but their contribution is more interesting than economic.

Currently there seems to be a renewed interest in chromite but there are no present markets for it in Oregon. Recently the U.S. Bureau of Mines has published the results of a study on the synthesis of rutile from domestic ilmenite. Rutile is a more efficient source of titanium than ilmenite which has iron combined with the titanium dioxide. Rutile used in the production of titanium metal at Albany comes principally from Australia. There is an abundance of ilmenite available in the U.S., but in Oregon the principal source would be the coastal sands and the main market would be at Albany with Wah Chang and Oremet.

Prices of foreign ores are steadily escalating and shipments may even be restricted in the foreseeable future. What might appear to be uneconomic today might very well be profitable tomorrow. I have no handle on the specs for or quantity of garnet that the new tire might require. Conceivably the Oregon garnets and chromite could be produced economically, with minor assists from the other co-products resulting from the beneficiation process, but a great deal of research and market study would have to be undertaken before sufficient data could be assembled to make a proper determination.

Sincerely yours,

Ralph S. Mason
Deputy State Geologist

RSM:lk

May 17, 1978

Mr. Barry Campbell
C.T.I.C.
P.O. Box 488
Cannon Beach, Oregon 97110

Dear Barry:

Enclosed is some information concerning black sand deposits in the Warrenton and Hammond areas. The Hammond black sand locality is from Bulletin 14-D, Oregon Metal Mines Handbook of Northwestern Oregon. The map attached is from investigations made by this Department in 1941. The map of Bunker Hill Company investigations for iron content is also enclosed.

For additional information on black sands, you should refer to Bulletin 64, 1969, Mineral and Water Resources of Oregon, and Bulletin 74, Environmental Geology of the Coastal Region of Tillamook and Clatsop Counties, Oregon, 1972. The complete Bunker Hill Company investigation report, including test data from drill holes, is available in our Portland library.

We are pleased to have been of assistance in your planning efforts.

Sincerely,

James L. Bela
Geologist

JLB:lk
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Mining of River Sands Sought

A Washington firm may attempt to recover iron from the sands at the mouth of the Columbia River.

The Natural Resources Committee of the Oregon House of Representatives has approved a bill to permit Oregon to lease Columbia River delta lands for mining.

The newly incorporated firm of Northwest Iron & Steel Co. of Tacoma reportedly is the firm interested.

Committee members said they understood the firm hopes to process millions of tons of low-grade iron sands.

The state of Washington already has passed legislation to permit leasing of delta lands on the Washington side of the Columbia.

Measure Could Permit Iron Ore Operations

*Oregonian
Feb 26
61*

A bill scheduled to come up for third reading in the House at Salem Wednesday would open the way for what is expected to be an extensive iron ore mining operation at the mouth of the Columbia River. The bill would permit the leasing of the delta lands at the mouth of the river where the black sands may contain rich iron ore deposits.

A Washington incorporated firm, the Northwest Iron & Steel Co., is interested in leasing the lands and putting in an iron ore separation plant on the Astoria side of the river, according to Phillip J. Roth, Portland attorney and former legislator who is Oregon representative for the company. He said the company has already leased delta lands on the Washington side of the river but that four fifths of the iron bearing sands are located on the Oregon side and would be needed for an operation of any size.

Big Production Seen

Roth reported that a new method, partly hydraulic and partly magnetic, for removing the iron from the sand would make the mining operation feasible. He estimated that the operation could ultimately develop into the mining of millions of tons of ore and with accompanying smelting would create a big payroll for Oregon.

The bill before the state Legislature was sponsored by the State Land Board and would permit that body to lease the delta lands in the Columbia River below the 46th parallel for mining operations.

The bill, HB 1732, has been recommended for passage by the house natural resources committee. It provides limiting of royalties to 10 per cent of the gross value of minerals removed.

Competitive bidding would be required and public hearings before leases could be granted. The maximum amount of land that could be leased in any one parcel would be limited to 640 acres. However a high bidder could lease an unlimited number of parcels.

BENEFICIATION OF
SOUTHWEST OREGON BEACH SANDS
BY HIGH TENSION
AND MAGNETIC DRY PROCESSING

BY

J. F. HUNT

PRESENTED AT THE
1960 PACIFIC NORTHWEST
METALS AND MINERALS CONFERENCE

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PORTLAND, OREGON

ABSTRACT

THE AUTHOR DESCRIBES THE ACTUAL PROCESSING OF THE GOVERNMENT STOCK-
PILE OF CHROMIFEROUS SANDS, LOCATED AT COQUILLE, OREGON, DURING 1955 AND
1956. A GENERAL HISTORY OF THE STOCKPILE IS GIVEN, ALONG WITH A BACKGROUND OF
THE GEOLOGY AND ORIGIN OF THESE SANDS. THE FLOW SHEET USED IN THIS OPERATION
IS OUTLINED IN DETAIL, AND THE MINERALS WON FROM THE STOCKPILE BY HIGH TENSION
AND MAGNETIC PROCESSING ARE DISCUSSED AS TO THEIR PURITY AND SALEABILITY.
AMONG THESE MINERALS ARE CHROMITE, ILMENITE, MAGNETITE, ZIRCON, GARNET,
RUTILE, MONAZITE, GOLD, AND PLATINUM. PLANNED POST-STOCKPILE OPERATIONS ON
THE PRESENT BEACH DEPOSITS ARE DISCUSSED. THESE OPERATIONS WOULD HAVE BEEN
CARRIED OUT TO SET UP A CONTINUOUS INTEGRATED MINING AND BENEFICIATION PROJECT,
EXCEPT FOR UNFORESEEN CIRCUMSTANCES WHICH DICTATED THE CLOSING OF THE OPERA-
TIONS AT THE EXHAUSTION OF THE GOVERNMENT STOCKPILE. THE PAPER IS ILLUSTRATED
WITH MAPS, FLOW SHEETS, CHARTS, AND PHOTOGRAPHS OF STOCKPILE, PLANT, AND
EQUIPMENT.

HISTORY AND BACKGROUND

CHROMIFEROUS SANDS, COMMONLY KNOWN AS "BLACK SANDS" BECAUSE OF THEIR COLOR, ARE FOUND BOTH IN THE PRESENT BEACHES AND ON RAISED MARINE TERRACES ALONG THE SOUTHERN OREGON COAST IN COOS AND CURRY COUNTIES. THESE DEPOSITS SEEM TO BE CONCENTRATED ON THE LOWER TERRACES BETWEEN CAPE ARAGO AND THE TOWN OF PORT ORFORD, AND IN THE SOUTH SLOUGH REGION (SEE USGS MAP, FIG. No. 1). THIS BLACK SAND OCCURS IN LAYERS AND LENSES THAT RANGE IN THICKNESS FROM A FEW INCHES UP TO 42 FEET; IN WIDTH, FROM A FEW TONS OF FEET TO MORE THAN 1,000 FEET AND, IN LENGTH, FROM A FEW HUNDRED FEET TO A MILE OR MORE. THE TERRACED DEPOSITS ARE COVERED WITH 1 TO 75 FEET OF SAND, CLAY, AND GRAVEL. BESIDES CHROMITE, OTHER VALUABLE MINERALS COMMON IN THESE BLACK SANDS INCLUDE ILMENITE, MAGNETITE, ZIRCON, GARNET, RUTILE, MONAZITE, GOLD, AND PLATINUM. OTHER RELATIVELY LESS VALUABLE MINERALS, OR THOSE FOR WHICH NO LARGE USE HAS BEEN FOUND, CONSIST OF QUARTZ, OLIVINE, PYROXENE, AND EPIDOTE, WHICH ARE CONSIDERED THE GANGUE MINERALS IN THESE DEPOSITS.

ALTHOUGH THE ULTIMATE SOURCE OF THE CHROMITE IN THESE BLACK SANDS IS THE MORE OR LESS SERPENTINIZED ULTRAMAFIC ROCK IN THE NEARBY COAST RANGE AND KLAMATH MOUNTAINS, MUCH OF THE CHROMITE PROBABLY HAS BEEN REWORKED FROM THE TERTIARY SEDIMENTARY ROCKS. TERTIARY SEDIMENTS AT THE NORTHERN END OF THE AREA ARE KNOWN TO CONTAIN CHROMITE, WHICH MUST HAVE BEEN ERODED OUT OF THE PERIDOTITES AND SERPENTINES. AFTER BEING RELEASED FROM THE ORIGINAL SOURCE, SOME OF THE CHROMITE WAS DEPOSITED IN THE TERTIARY SEDIMENTS, AND THEN RELEASED AGAIN, AND CONCENTRATED IN THE PRESENT TERRACES.

USGS BULLETIN 945-E, PRINTED IN 1945, FROM WHICH MUCH OF THE HISTORY AND GEOLOGY FOR THIS PAPER WAS OBTAINED, STATES THAT THE KNOWN RESERVES AT THAT DATE, OF MEASURABLE AND INDICATED ORE IN THE TERRACES WERE 1,913,000 LONG TONS OF SAND IN DEPOSITS AVERAGING MORE THAN 5% Cr_2O_3 AND 1,212,000 LONG TONS OF SAND IN DEPOSITS AVERAGING BETWEEN 3% AND 5% Cr_2O_3 . IT WAS ESTIMATED THAT THE PRESENT, OR ACTIVE BEACHES, CONTAINED 100,000 LONG TONS OF SAND CONTAINING 5% OR MORE Cr_2O_3 . THE RESERVES IN MANY OF THE DEPOSITS CAN BE SUBSTANTIALLY INCREASED WITH MORE DETAILED EXPLORATION, AND OTHER FAVORABLE REGIONS NOT YET EXPLORED.

IN 1943, TWO PLANTS (ONE OWNED BY HUMPHREYS GOLD CORPORATION AND THE OTHER BY KROME CORPORATION) BEGAN MAKING ROUGH CHROMITE CONCENTRATIONS, BY WET GRAVITY OPERATIONS, WHICH WERE TRUCKED TO A THIRD PLANT FOR TREATMENT. THIS THIRD PLANT HAS BEEN CONSTRUCTED BY THE DEFENSE PLANT CORPORATION FOR THE PURPOSE OF UPGRADING OR BENEFICIATING THESE CHROMITE CONCENTRATES FROM A VALUE OF AROUND 25% Cr_2O_3 TO ABOUT 40% Cr_2O_3 . A SMALL TONNAGE OF UP-GRADED CONCENTRATES WAS PRODUCED IN THIS DEFENSE PLANT, BUT DUE TO TECHNICAL PROBLEMS, AND CONTRACT CANCELLATIONS DUE TO END OF WORLD WAR II, THE COMPLETE OPERATIONS OF MINING AND BENEFICIATION WERE CLOSED, LEAVING APPROXIMATELY 65,000 LONG TONS OF ROUGH CONCENTRATES IN THE GOVERNMENT STOCKPILE, ABOUT FIVE MILES NORTH OF COQUILLE ON ROUTE US 101.

THIS STOCKPILE REMAINED THERE UNTIL 1954, IN WHICH YEAR THE CHROMIUM MINING AND SMELTING CORPORATION, THROUGH THEIR SUBSIDIARY, THE PACIFIC NORTHWEST ALLOYS, INC., OF SPOKANE, WASHINGTON, CONTRACTED WITH THE GENERAL SERVICES ADMINISTRATION OF THE U. S. GOVERNMENT TO REMOVE THE CHROMITE BY

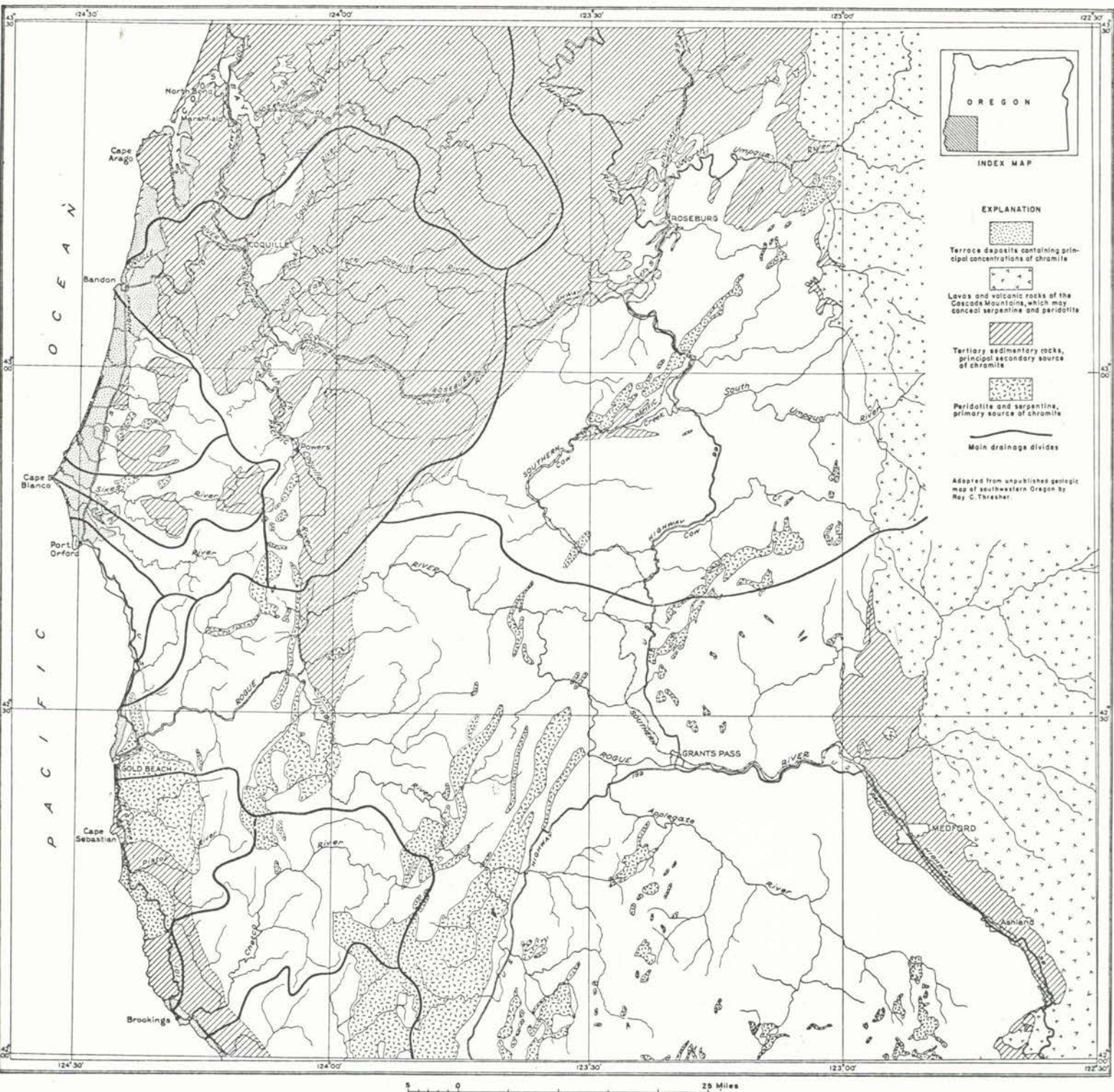


FIGURE 1

MODERN BENEFICIATION METHODS. THIS CHROMITE WOULD THEN BE SHIPPED TO THEIR SPOKANE SMELTER FOR CONVERSION INTO FERROCHROMIUM ALLOY. ANY OTHER MINERALS REMOVED ALONG WITH THE CHROMITE WERE THE PROPERTY OF PNA, TO BE UPGRADED, PURIFIED, AND SOLD ON THE OPEN MARKET. I ACCEPTED A POSITION AT THIS TIME WITH PACIFIC NORTHWEST ALLOYS AS WORKS MANAGER OF THIS PROJECT. WE BELIEVE WE WERE THE FIRST FERROALLOY PRODUCER IN THE U. S. TO UPGRADE SUCH LOW GRADE DOMESTIC ORES AND PROCESS THEM INTO HIGHLY USABLE AND COMMERCIALY ACCEPTABLE VACUUM PRODUCED FERROCHROMIUM.

GROUND CLEARING AND LEVELING TO PUT UP THIS MINERAL BENEFICIATION PLANT ADJACENT TO THE STOCKPILE WAS STARTED IN OCTOBER, 1954. MINERAL PROCESSING STARTED SIX MONTHS LATER, IN APRIL, 1955. COMPLETION OF THE STOCKPILE WAS ACCOMPLISHED IN AUGUST, 1956 (SEE FIGS. NO. 2 AND NO. 3).

AS THE STOCKPILE WAS BUILT UP, THE HUMPHREYS GOLD CORPORATION FED IT WITH A HEAVY MINERAL CONCENTRATE PRODUCED BY SPIRALS FROM THE LAGOONS OPERATION; AND THE KROME CORPORATION WITH A CONCENTRATE PRODUCED BY WET TABLING FROM THE 7 DEVILS MINE. THE TOTAL STOCKPILE VARIED CONSIDERABLY, IN COMPOSITION, FROM TONNAGE TO TONNAGE, BUT RAN FROM 54% TO 58% CHROMITE, 12% TO 20% ILMENITE, 3% TO 4% MAGNETITE, 12% TO 17% GARNET, 3% TO 5% ZIRCON, AND UP TO 11% SCRAP OR GANGUE MINERALS.

FLOW SHEET

TO RECOVER THESE MINERALS AND UPGRADE THEM TO SALEABLE PRODUCTS, THE FOLLOWING FLOW SHEET WAS USED (SEE ACCOMPANYING FLOW SHEET, FIG. NO. 4).

THE STOCKPILE ORE IS BROUGHT INTO THE SCREENING AND WASHING PLANT BY MEANS OF A MUCKER DRAGLINE, USING A 3/4 YARD CRESCENT BUCKET WHICH DUMPS

THE ORE THROUGH A GRIZZLEY INTO A HOPPER. BY MEANS OF A SCREW IN THE BOTTOM OF THE HOPPER, THE ORE IS CONVEYED TO A POIDOMETER AUTOMATIC WEIGHING MACHINE FOR ORE TONNAGE RECORDS. AT THIS SAME POINT, THE ORE IS AUTOMATICALLY SAMPLED FOR ANALYSES AND MOISTURE DETERMINATIONS. AFTER WEIGHING, THE POIDOMETER DELIVERS THE ORE TO A BUCKET ELEVATOR FEEDING A WET VIBRATING 20 MESH SCREEN WHICH BREAKS UP ORE CONGLOMERATES AND REMOVES FOREIGN WASTE MATERIAL. THE SCREEN UNDERAGE FLOWS INTO THE SUMP OF A WILFLEY SAND PUMP WHICH PUMPS THE SLURRY TO A DEWATERING CONE, THE UNDERAGE FROM WHICH DROPS INTO A DEWATERING SCREW (THE CONE IS NOT SHOWN IN THE FLOW SHEET). THE DEWATERED PULP, CONTAINING ABOUT 15% MOISTURE, IS ELEVATED BY MEANS OF A CHEVRON STACKER BELT AND IS DROPPED INTO PILES ON A CONCRETE DRAIN SLAB. THESE PILES OF SAND WILL DRAIN TO ABOUT 9% MOISTURE AND ARE THEN CHARGED INTO AN OIL FIRED ROTARY DRYER BY MEANS OF A FRONT END LOADER FEEDING A CONTINUOUS BUCKET ELEVATOR.

THE SAND EMERGES FROM THE DRYER AT AROUND 300° F., DROPPING INTO THE BOOT OF A CHAIN ELEVATOR WHICH DELIVERS IT TO A 100 TON DRY, HEAVY SAND, STORAGE TANK. FLOWING FROM THE BOTTOM OF THIS TANK, THE HOT SAND IS FED BY MEANS OF AN ELEVATOR THROUGH A DISTRIBUTOR BOX TO A CARPCO HIGH TENSION SEPARATOR SYSTEM, CONSISTING OF EIGHT ROTORS. THIS MACHINE SEPARATES THE CONDUCTOR MINERALS, CONSISTING OF CHROMITE, MAGNETITE, ILMENITE, RUTILE, GOLD, AND PLATINUM, FROM THE NONCONDUCTOR MINERALS, CONSISTING OF ZIRCON, GARNET, AND QUARTZ, BY A HIGH VOLTAGE DISCHARGE. THE CONDUCTOR MINERALS ARE THROWN FROM THE SPINNING ROTORS, AND ARE CALLED THE "THROWN FRACTION." THE NONCONDUCTOR MINERALS ARE PINNED TO THE SPINNING ROTORS AND HAVE TO BE BRUSHED OFF. THESE NONCONDUCTORS ARE CALLED THE "PINNED FRACTION."

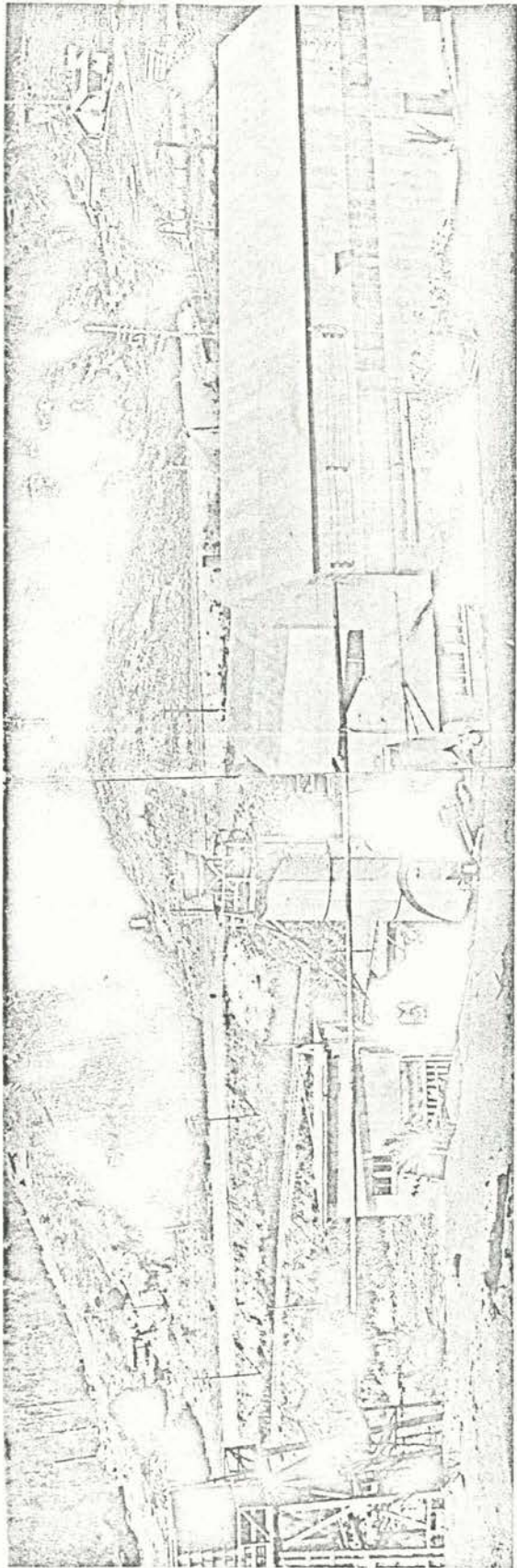
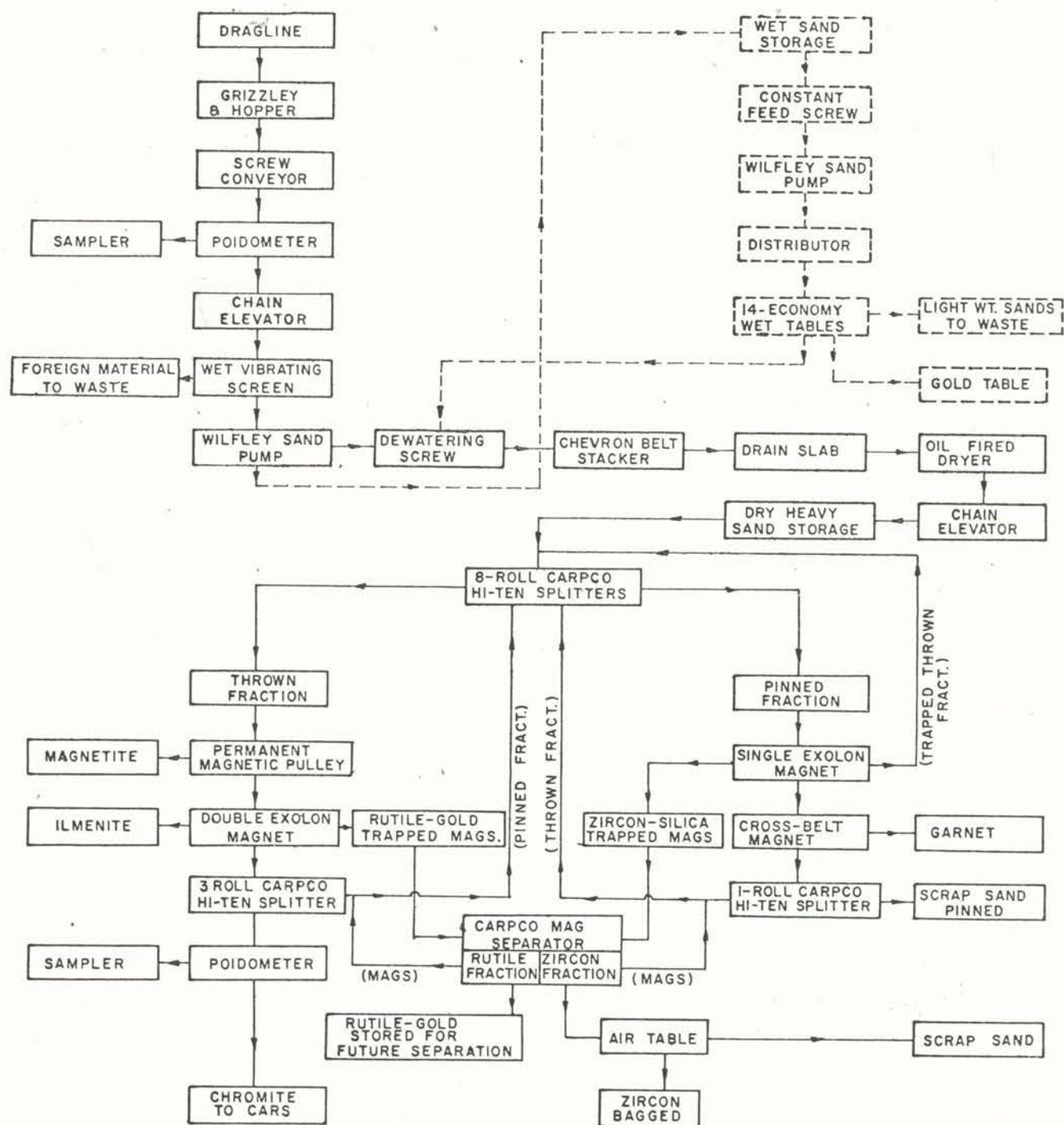


FIGURE 3



FIGURE 2

FLWSHEET COQUILLE DIV. PLANT-PACIFIC NORTHWEST ALLOYS, INC.



NOTE:

BROKEN LINES INDICATE INSTALLED
EQUIPMENT NOT IN USE AT PRESENT

COQUILLE, OREGON
AUGUST 25, 1955
J. F. HUNT

THE MINERALS IN THE THROWN FRACTION ARE THEN COLLECTED BY A SYSTEM OF CONVEYORS AND ELEVATORS AND PASSED OVER A PERMANENT MAGNETIC PULLEY, WHICH PULLS OUT SALEABLE MAGNETITE. THE REMAINDER OF THIS FRACTION THEN PASSES THROUGH AN INDUCED ROLL EXOLON MAGNETIC SEPARATOR WHICH PULLS OUT THE ILMENITE AS A SALEABLE PRODUCT, PULLS OUT THE SEMICONCENTRATED CHROMITE AND PASSES THROUGH THE NONMAGNETIC RUTILE AND GOLD FRACTION. THE SEMICONCENTRATED CHROMITE IS THEN FED TO THREE ROTORS OF ANOTHER CARPCO HIGH TENSION SEPARATOR, WHICH CLEANS IT UP TO A 42% MINIMUM Cr_2O_3 CHROMITE WHICH IS THEN READY FOR SHIPMENT TO THE ALLOY SMELTER. THIS FINISHED CHROMITE IS WEIGHED ON A POIDOMETER AND SAMPLED BEFORE SHIPMENT. THE RUTILE-GOLD FRACTION THAT PASSES THROUGH THE EXOLON MAGNET, ALONG WITH TRAPPED MAGNETICS, IS SENT TO A CARPCO INDUCED ROLL MAGNETIC SEPARATOR, WHICH REMOVES THE REMAINING MAGNETICS WHICH, IN TURN, ARE CONVEYED BACK TO THE HEAD FEED OF THE 8 ROTOR CARPCO HIGH TENSION SEPARATOR, AND PASSES THE RUTILE-GOLD FOR STORAGE AND FUTURE SEPARATION.

LIKewise, THE MINERALS IN THE PINNED FRACTION ARE COLLECTED AND PASSED DIRECTLY THROUGH ANOTHER INDUCED ROLL EXOLON MAGNETIC SEPARATOR, WHICH PULLS OUT THE TRAPPED CONDUCTORS WHICH, IN TURN, ARE CONVEYED BACK TO THE HEAD FEED OF THE 8 ROTOR CARPCO MACHINE. THIS EXOLON ALSO PULLS OUT A SEMICONCENTRATED GARNET, WHICH IS PASSED TO A CROSS-BELT MAGNET FOR PULLING OUT AND PRODUCING A SALEABLE GARNET. THE NONMAGNETIC ZIRCON AND SILICA FRACTION PASS THROUGH THE EXOLON. THIS LATTER FRACTION, ALONG WITH TRAPPED MAGNETICS, IS SENT TO THE CARPCO INDUCED ROLL MAGNETIC SEPARATOR WHICH REMOVES THE MAGNETICS WHICH, IN TURN, ARE CONVEYED BACK TO THE HEAD FEED OF THE CARPCO 8 ROTOR

MACHINE AND PASSES THE ZIRCON-SILICA TO A GRAVITY AIR TABLE FOR REMOVAL OF THE SILICA AND PRODUCTION OF SALEABLE ZIRCON. THE NONMAGNETICS COMING FROM THE CROSS-BELT MAGNET ARE THEN FED TO THE FOURTH ROTOR OF THE OTHER CARPCO HIGH TENSION SEPARATOR, WHICH PRODUCES A THROWN FRACTION TO BE RETURNED TO THE HEAD FEED OF THE 8 ROTOR CARPCO AND PINS OUT A SCRAP THROW AWAY SAND.

THE BROKEN LINES IN THE FLOW SHEET INDICATE PROCESSING AND EQUIPMENT THAT WAS INSTALLED BUT NOT USED AFTER A FEW WEEKS' RUN. THIS EQUIPMENT OCCURS IN THE FLOW SHEET BETWEEN THE WILFLEY SAND PUMP FOLLOWING THE WET VIBRATING SCREEN AND THE DEWATERING SCREW AND CONSISTED OF A WET SAND STORAGE TANK DELIVERING ITS CHARGE TO A CONSTANT FEED SCREW, THENCE TO A SAND PUMP, PUMPING THE SLURRY TO A DISTRIBUTOR FEEDING 14 ECONOMY WET TABLES. THESE TABLES EXTRACTED THE LIGHT WEIGHT SANDS (PRIMARYLY SILICA), WHICH WERE SLICED TO WASTE, TOOK OFF A TOP, EXTRA HEAVY MINERAL CONCENTRATE (PRIMARYLY MAGNETITE AND GOLD AND PLATINOIDS) WHICH WAS LAUNDERED TO ANOTHER SMALLER WET TABLE FOR REMOVAL OF GOLD AND PLATINOIDS, AND DELIVERED THE REGULAR HEAVY MINERAL CONCENTRATE, BY LAUNDERS, TO THE DEWATERING SCREW.

BUT, DUE TO THE RELATIVELY LOW PERCENTAGE OF LIGHT WEIGHT SCRAP MINERALS (AROUND 10%) IN THE STOCKPILE, IT WAS FOUND UNNECESSARY TO REMOVE THIS FRACTION BY THE TABLES, SINCE THE CARPCO SEPARATORS COULD HANDLE AND DISPOSE OF IT QUITE EASILY. AS FOR THE GOLD CIRCUIT, IT WAS FOUND OUT THE CONCENTRATES IN THIS STOCKPILE HAD BEEN PREVIOUSLY HIGH-GRADED FOR GOLD DURING THE PRIMARY GRAVITY SEPARATION, THEREFORE, THERE WAS NOT ENOUGH GOLD LEFT IN THE STOCK-PILE TO ALLOW AN ECONOMICAL OPERATION OF THIS CIRCUIT.

PRINCIPLE OF OPERATION OF THE CARPCO HIGH TENSION SEPARATOR

THE HIGH TENSION (OR ELECTRODYNAMIC) SEPARATOR SEPARATES ONE MINERAL FROM ANOTHER BY THE DIFFERENCE IN ELECTRICAL CONDUCTIVITY OF THE MINERALS; WHEREAS A MAGNETIC SEPARATOR SEPARATES MINERALS BECAUSE OF THEIR DIFFERENCES IN MAGNETIC SUSCEPTIBILITY (SEE FIGS. NO. 5, 6, 7, 8, 9, AND 10).

BY A COMBINATION OF THESE TWO TYPE MACHINES, ALONG WITH USING THE ADVANTAGE OF DIFFERENCES IN SPECIFIC GRAVITY, WHERE NECESSARY, MANY SUITES OF MINERALS CAN BE SEPARATED (SEE SEPARATION CHARACTERISTICS OF MINERALS CHART, FIG. NO. 11).

HIGH TENSION SEPARATION SHOULD NOT BE CONFUSED WITH ELECTROSTATIC SEPARATION. AN ACTUAL ELECTRICAL CURRENT FLOW TAKES PLACE IN A HIGH TENSION SEPARATOR IN THE FORM OF A CORONA DISCHARGE WHICH PLACES AN ELECTRICAL CHARGE ON THE MINERAL PARTICLES BEING PROCESSED. IN AN ELECTROSTATIC SEPARATOR, THE MINERALS MUST BE ELECTRICALLY CHARGED IN SOME MANNER OR OTHER BEFORE ENTERING THE SEPARATION SYSTEM. HAVING BEEN CHARGED, THE MASS OF MINERALS ARE THEN PASSED BETWEEN POSITIVE AND NEGATIVE ELECTRODES, THE POSITIVELY CHARGED PARTICLES BEING DEFLECTED TOWARD THE NEGATIVE ELECTRODE AND THE NEGATIVELY CHARGED PARTICLES BEING DEFLECTED OR ATTRACTED TOWARD THE POSITIVE ELECTRODE.

IN THE CARPCO HIGH TENSION SEPARATOR, THE MIXTURE OF MINERALS IS FED THROUGH A DISTRIBUTION HOPPER ONTO A HORIZONTAL ELECTRICALLY GROUNDED SPINNING ROTOR (SEE FIG. NO. 12). THIS ROTOR CARRIES THE MINERAL PARTICLES THROUGH A SPRAY OF ELECTRONS OR CORONA DISCHARGE CREATED BY A HIGH VOLTAGE CHARGED WIRE

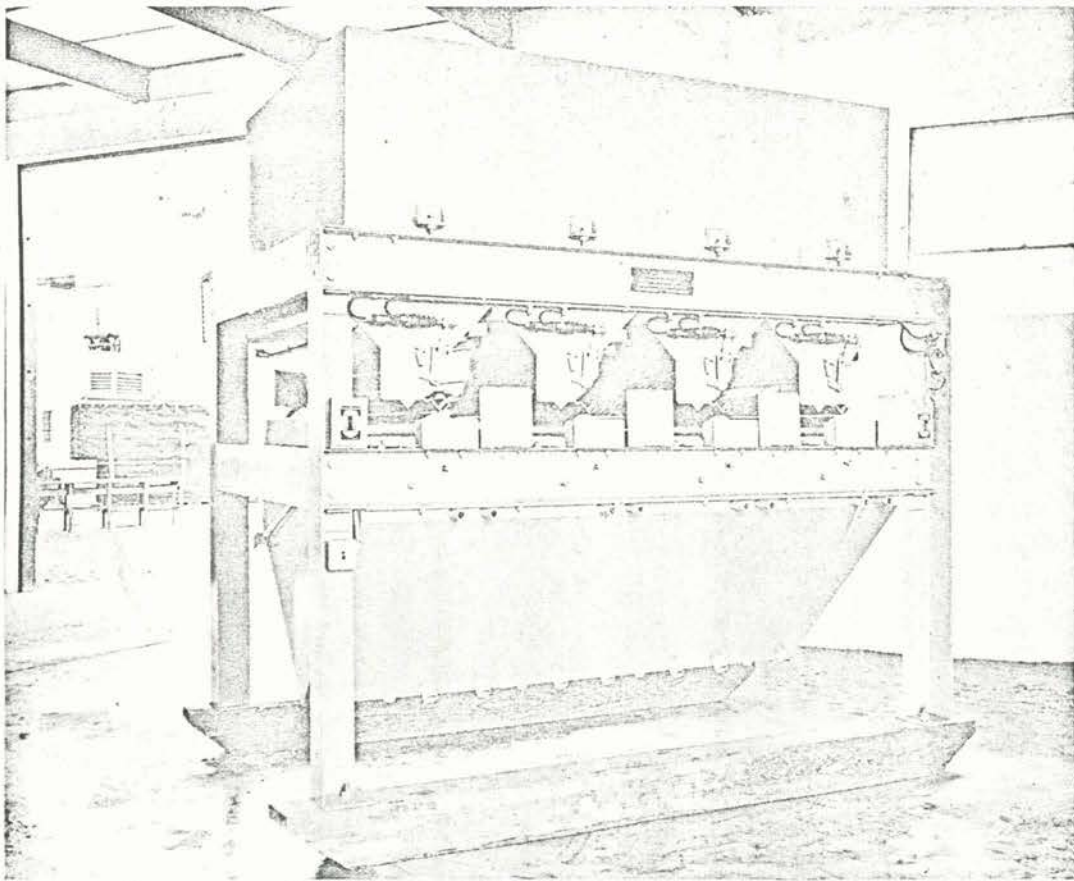
ELECTRODE WHICH IS BEAMED OR POINTED AT THE SPINNING, GROUNDED ROTOR. EVERY MINERAL PARTICLE ACCEPTS THE CHARGE THROWN OFF BY THE WIRE ELECTRODE. THE CONDUCTIVE PARTICLES IMMEDIATELY DISSIPATE THIS CHARGE AND, DUE TO THE TANGENTIAL FORCES OF THE SPINNING ROTOR, ARE THROWN FORWARD INTO A THROWN OR CONDUCTOR MINERAL HOPPER. THE NONCONDUCTIVE PARTICLES ACCEPT AND HOLD ONTO THIS CHARGE, WHICH IS OPPOSITE TO THE CHARGE OF THE ROTOR, AND CONSEQUENTLY ARE PINNED TO, OR STICK TO THE SPINNING ROTOR. THESE PARTICLES ARE CARRIED TO THE BACK OF THE ROTOR AND BRUSHED OFF INTO A PINNED OR NONCONDUCTOR MINERAL HOPPER. AS IN MOST TYPES OF MINERAL SEPARATORS, THERE IS A MIDDLEINGS HOPPER, IF REQUIRED, TO CATCH AGGLOMERATED CONDUCTOR AND NONCONDUCTOR PARTICLES, AND TO ALLOW THE SYSTEM TO PRODUCE HIGHER PURITY CONCENTRATES. THESE MIDDLEINGS ARE USUALLY CIRCULATED TO HEAD FEED.

THE HIGH VOLTAGE WHICH PRODUCES THE CORONA DISCHARGE IN THE CARPCO SEPARATOR IS PRODUCED BY A SPECIALLY DESIGNED DC RECTIFIER SYSTEM. VOLTAGES USED VARY FROM 25,000 TO 40,000.

DISCUSSION OF MINERAL VALUES AND SALEABILITY

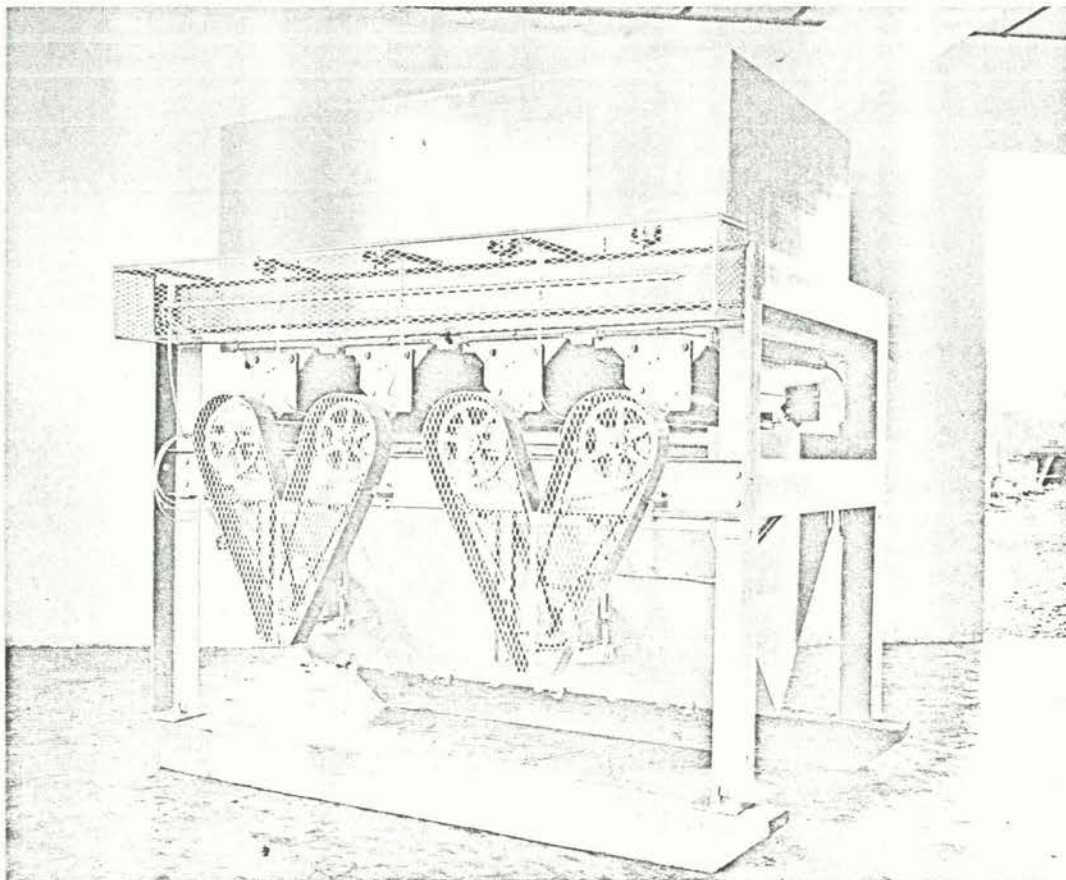
THE COQUILLE PLANT, WHICH COST IN THE NEIGHBORHOOD OF \$300,000, INCLUDING CLEARING OF THE PLANT SITE, BUILDINGS, EQUIPMENT AND ALL, AVERAGED AROUND 175 TONS PER DAY OF STOCKPILE FEED, AFTER BREAKING IN.

FROM THIS FEED WERE PRODUCED 80 TO 90 TONS OF CHROMITE PER DAY, ASSAYING 42% TO 43% Cr_2O_3 , WITH A CR-FE RATIO OF AROUND 1.5:1.0. ALL THIS BENEFICIATED CHROMITE WAS SHIPPED IN BULK RAILROAD CARS (EITHER HOPPERS OR GONDOLAS) TO THE SPOKANE PLANT OF PACIFIC NORTHWEST ALLOYS, WHERE IT WAS PROCESSED



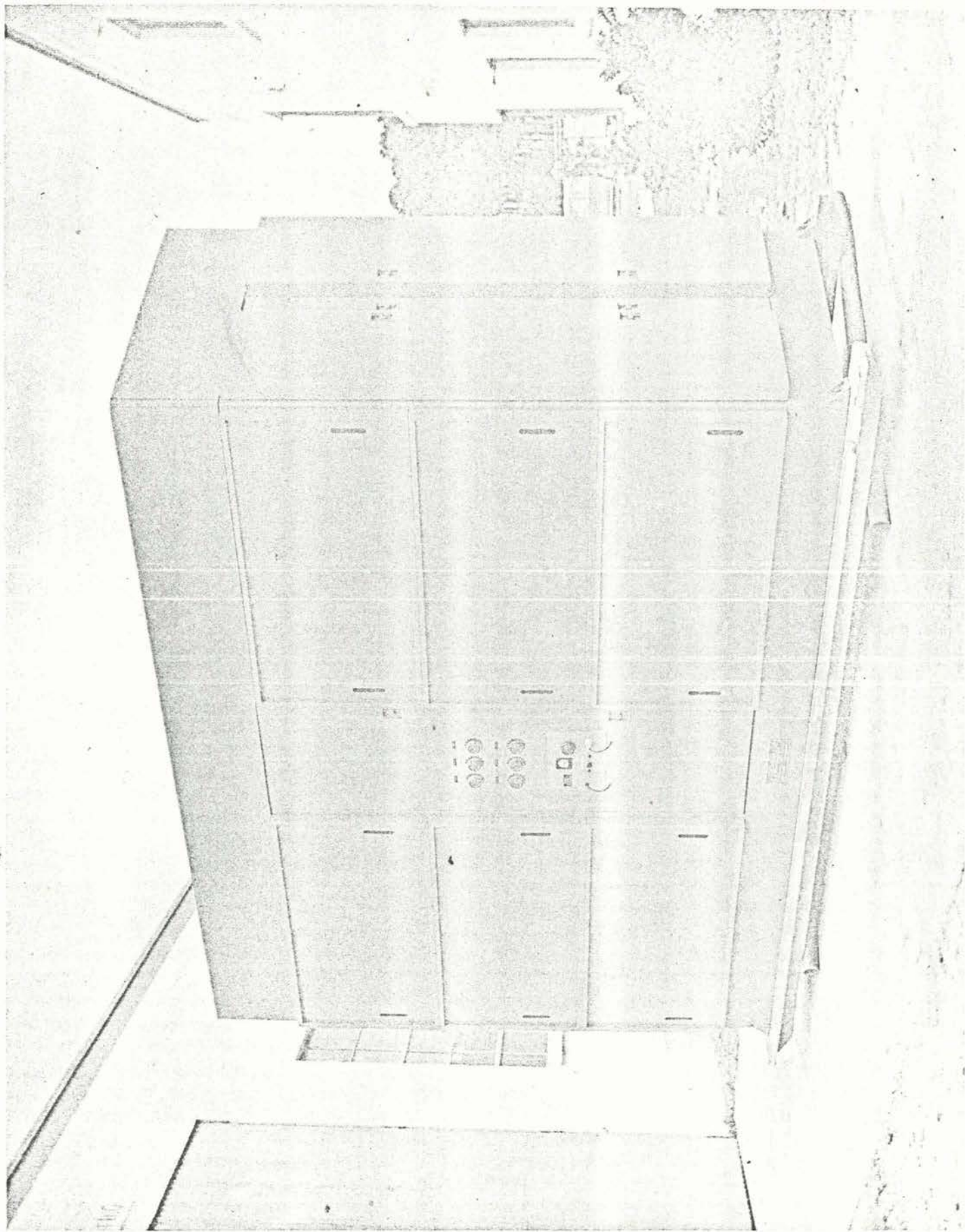
OPERATING SIDE CARPCO HT-460 HIGH TENSION SEPARATOR
TYPE USED AT COQUILLE PLANT

FIGURE 5



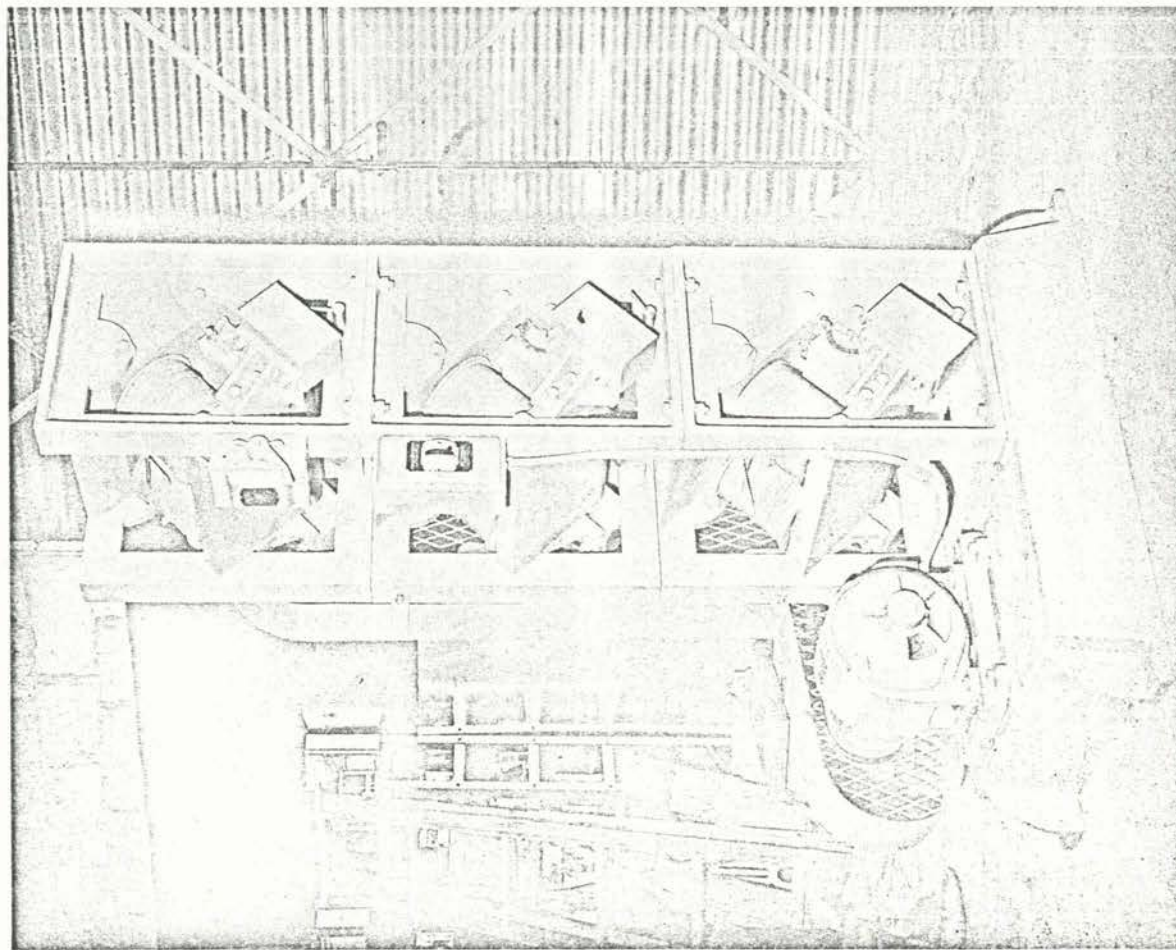
REAR VIEW CARPCO HT-460 HIGH TENSION SEPARATOR
TYPE USED AT COQUILLE PLANT

FIGURE 6



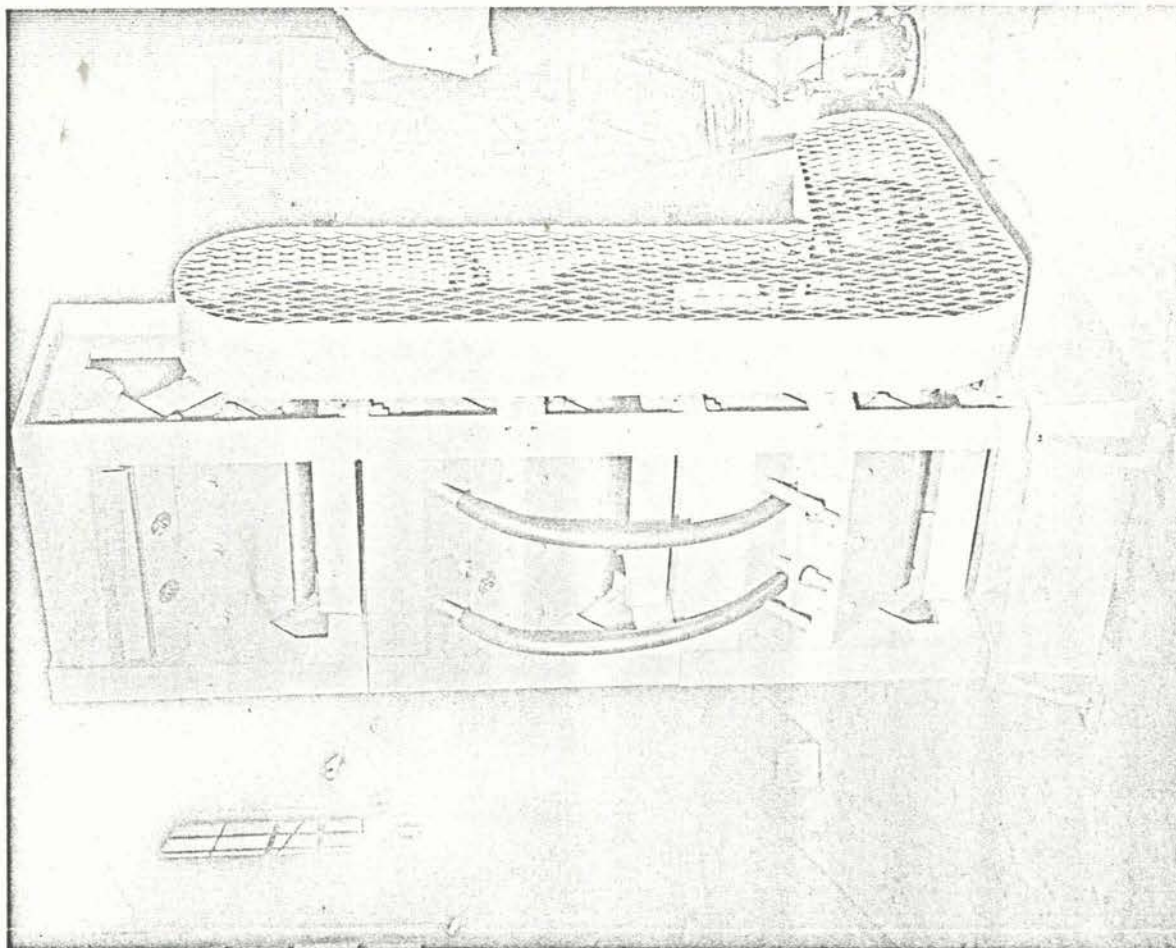
LATEST MODEL CARPCO HTV-23120 HIGH TENSION TOTALLY ENCLOSED VERTICAL BANK SEPARATOR

FIGURE 7



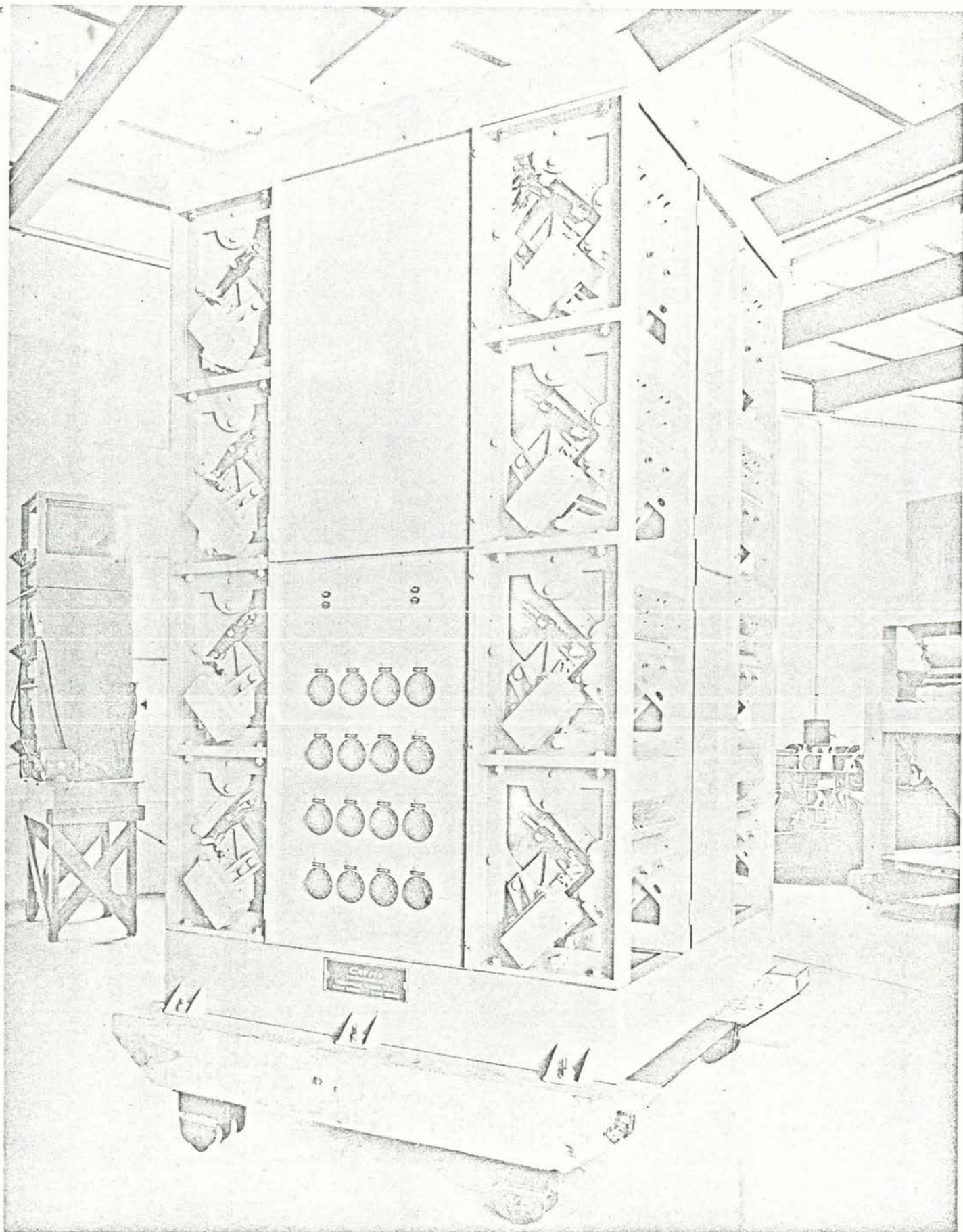
OPERATING SIDE CARPCO MI-318 INDUCED ROLL MAGNETIC SEPARATOR
TYPE USED AT COQUILLE PLANT

FIGURE 8



REAR VIEW CARPCO MI-318 INDUCED ROLL MAGNETIC SEPARATOR
TYPE USED AT COQUILLE PLANT

FIGURE 9



LATEST MODEL CARPCO MI-2436 INDUCED ROLL MAGNETIC SEPARATOR

FIGURE 10

CARPCO RESEARCH AND ENGINEERING
JACKSONVILLE, FLORIDA, U.S.A.
SEPARATION CHARACTERISTICS OF MINERALS

NON-CONDUCTORS (HIGH TENSION PINNED)				CONDUCTORS (HIGH TENSION THROWN)				SPECIFIC GRAVITY
SP. G.	MAGNETIC	WEAKLY MAGNETIC	NON MAGNETIC	HIGHLY MAGNETIC	MAGNETIC	WEAKLY MAGNETIC	NON MAGNETIC	
Over 8.0							Gold Copper	Over 8.0
8.0						Tantalite		8.0
7.5							Galena	7.5
7.0					Ferberite	Wolframite	Cassiterite Wulfenite	7.0
6.5								6.5
6.0			Scheelite					6.0
5.5						Samarskite		5.5
5.0	Monazite	Bastnasite		Magnetite		Columbite Hematite Franklinite	Pyrite	5.0
4.5	Xenotime		Zircon Barite	Ilmenite— (High Iron)	Ilmenite Davidite	Euxenite Chromite	Molybdenite Koppite	4.5
4.0	Garnet Siderite Staurolite		Perovskite Corundum Celestite			Ilvaite Marmatite	Rutile Chalcopyrite Brookite Sphalerite	4.0
3.5		Epidote Olivine Hornblende Apatite Tourmaline	Kyanite Diamond Topaz Sphene Sillimanite Fluorite				Acmite Augite	3.5
3.0		Mica (Biotite)	Anhydrite Mica (Muscovite) Beryl Feldspars Calcite Quartz					3.0
2.5			Gypsum Chrysotile Sulphur				Graphite	2.5
2.0								2.0
Under 2.0								Under 2.0

EXPLANATION OF TABLE:

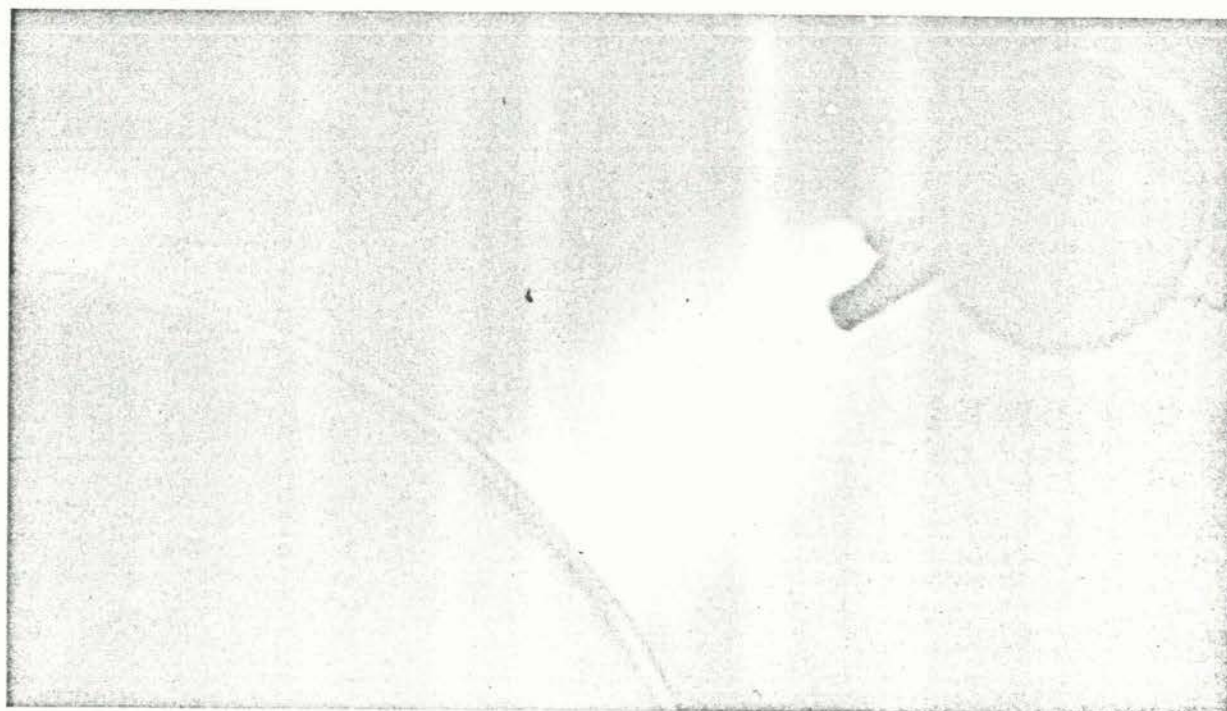
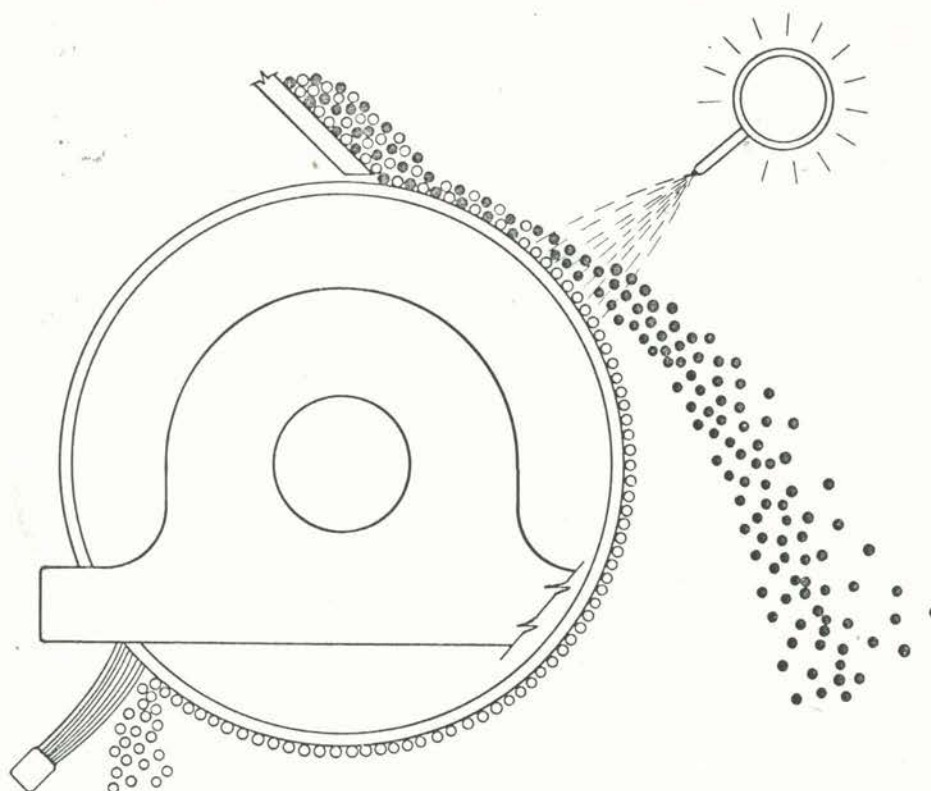
Starting with a mixture of any of the above minerals it may be determined whether or not they can be separated by high tension, magnetic, or gravity methods and whether any one, or a combination of methods is required. If the minerals appear in different columns they may be separated by high tension and/or magnetic methods alone. Two or more minerals appearing in the same column can be separated by gravity concentration if they have sufficient difference in gravity (usually a difference of approximately 1.0).

It should be noted that grain shape and/or size may alter separation characteristics. This is sometimes a detriment and other times useful. As an example, mica and quartz may in many cases be separated by high tension, due to their grain shape.

Minerals behavior characteristics shown are from tests made in our laboratories rather than theoretical. Mineral characteristics and behaviors sometimes vary from different deposits. The behavior of minerals not shown can usually be predicted by the behavior of similar minerals in the above table.

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FIGURE II



CORONA DISCHARGE (SOURCE OF IONS)

FIGURE 12

INTO VACUUM PRODUCED FERROCHROMIUM ALLOY.

METALLURGICAL SPECIFICATIONS FOR CHROMITE IN THE PAST HAVE CALLED FOR ORES HIGH IN Cr_2O_3 AND A CR-Fe RATIO OF 2:1 OR BETTER. THIS OREGON CHROMITE IS CONSIDERED LOW GRADE METALLURGICALLY; HOWEVER, THE PNA PROCESS MADE USE OF IT QUITE SATISFACTORILY.

CHEMICAL SPECIFICATIONS FOR CHROMITE CALL FOR ORES THAT ARE EASILY DECOMPOSED, THAT IS, HIGH IN IRON. I FEEL THIS OREGON CHROMITE, DUE TO ITS SMALL PARTICLE SIZE AND HIGH IRON CONTENT, UP AROUND 20% TO 21% Fe, WOULD FIND GOOD USAGE AS A RAW MATERIAL IN THE CHEMICAL INDUSTRY.

REFRACTORY GRADE CHROMITE SPECIFICATIONS SET A RELATIVELY HIGH PERCENTAGE OF Al_2O_3 AS IMPORTANT. OREGON CHROMITE RUNS AROUND 15% Al_2O_3 WITH AN MgO CONTENT OF AROUND 9% . THESE REFRACTORY OXIDE VALUES WARRANT SERIOUS CONSIDERATION BY THE CHROME REFRACTORY INDUSTRY.

IT IS INTERESTING TO NOTE THAT AROUND 2-1/2 MILLION TONS OF CHROMITE OF ALL GRADES, PER YEAR, ARE USED IN THE UNITED STATES, AND AROUND 95% OF THIS TONNAGE IS IMPORTED FROM TURKEY, RHODESIA, PHILIPPINES AND OTHER FOREIGN COUNTRIES.

THE ZIRCON WE PRODUCED FROM THE STOCKPILE ASSAYED AROUND 66% ZrO_2 AND 33.7% SiO_2 WITH LOW FRACTIONAL PERCENTAGES OF Ti, Fe, AND Cr. THIS WAS CONSIDERED A CERAMIC GRADE ZIRCON AND WAS BAGGED IN 100 POUND, 5-PLY PAPER BAGS AND, AS I RECALL, THE GREATER PORTION WAS SOLD TO THE FOUNDRY INDUSTRY HERE IN PORTLAND WHERE IT WAS USED AS A SUPER REFRACTORY MOLD AND CORE FACING. OTHER FOUNDRY USES OF ZIRCON ARE AS A MOLD WASH AND IN THE MAKE UP OF CHILLS. THIS GRADE ZIRCON WOULD FIND WIDE USE IN THE CERAMIC INDUSTRY AS A RAW MATERIAL IN

THE MAKE UP OF BODIES, GLAZES, VITREOUS ENAMELS, REFRACTORIES, ELECTRICAL CEMENTS, SAGGER WASHES, GLASSES, ETC.; IN THE CHEMICAL INDUSTRY AS THE BASIS FOR THE MANUFACTURE OF THE MANY ZIRCONIUM COMPOUNDS; IN THE METALLURGICAL INDUSTRY FOR THE PRODUCTION OF ZIRCONIUM METAL AND ITS ALLOYS.

THE GARNET PRODUCED WAS BAGGED AND SHIPPED TO PORTLAND AND SAN FRANCISCO FOR GENERAL SAND BLASTING AND ABRASIVE USE. IT IS A BRICK-RED CRYSTAL, ROUNDED, NOT SHARP, AND VERY TOUGH. IT IS AN EXCELLENT BLASTING SAND FOR SOFT METALS AND WOODS. IT TENDS TO PRODUCE A PEENING RATHER THAN A CUTTING ACTION. THIS GARNET WAS USED MOSTLY IN FOUNDRIES AND SHIPBUILDING YARDS.

THE MAGNETITE AND ILMENITE FRACTIONS PRODUCED IN THIS FLOW SHEET, DUE TO THE RELATIVELY HIGH PERCENTAGES OF CR AND TI IN THE MAGNETITE AND CR IN THE ILMENITE, WERE NOT SALEABLE FOR THEIR GENERAL USAGES SUCH AS IRON ORE AND PIGMENT MANUFACTURE RESPECTIVELY. FURTHER BENEFICIATION OR PROCESSING WOULD UNDOUBTEDLY HAVE PRODUCED THESE MINERALS IN A PURER FORM FOR THEIR GENERAL USAGES. WE MIXED THESE TWO FRACTIONS TOGETHER, BAGGED THEM, AND HAD A + 140 MESH, HEAVY BLACK SAND, ROUNDED GRAINS, SPECIFIC GRAVITY OF APPROXIMATELY 5.0, WHICH WE SOLD TO THE ROOFING PAPER MANUFACTURERS IN PORTLAND AND SAN FRANCISCO. THEY USED IT PRIMARILY AS AN OPAQUE MEDIUM FOR PROTECTING THE BITUMEN IN ROOFING PAPER FROM THE ROTTING ACTION OF THE SUN'S RAYS. THIS BLACK SAND MIXTURE COULD ALSO BE USED AS A WEIGHTING SAND AND IN HEAVY MEDIA SEPARATIONS.

AS PREVIOUSLY NOTED, THE PERCENTAGES OF RUTILE, MONAZITE, GOLD AND PLATINUM IN THIS STOCKPILE WERE TOO LOW TO ECONOMICALLY RECOVER IN OUR OPERATION. HOWEVER, IN OUR LABORATORY, WE CONCENTRATED BATCHES FROM TIME TO TIME FROM AN ACADEMIC INTEREST ONLY. THE RUTILE CONCENTRATED OUT AT BETWEEN 95% AND

96% TiO_2 WITH ONLY FRACTION AND TRACE PERCENTAGES OF SUCH CONTAMINANTS AS CR, FE, VA, ZR AND P. HAD THERE BEEN SUFFICIENT TONNAGE OF THIS RUTILE, IT WOULD HAVE BEEN HIGHLY SALEABLE TO THE WELDING ROD, TI-METAL AND TI-COMPOUND INDUSTRIES. ALTHOUGH WE MADE NO ANALYSES ON THE MONAZITE SEPARATIONS, PHYSICAL EXAMINATIONS INDICATED THEY WERE HIGH GRADE CONCENTRATES. THE GOLD CONCENTRATED OUT WAS IN THE FORM OF SMALL FLAT FLAKES AND THE PLATINUM IN THE FORM OF SMALL PLATINOID PARTICLES. I HAVE SAMPLES OF ALL THESE CONCENTRATES WITH ME FOR THOSE OF YOU WHO ARE INTERESTED IN EXAMINING THEM.

PLANNED POST-STOCKPILE OPERATIONS

WITH PLANS OF CONTINUING THE OPERATION AFTER EXHAUSTION OF THE STOCKPILE, WE ACQUIRED A SUBSTANTIAL ACREAGE OF LAND BEARING KNOWN CHROMITE DEPOSITS IN THE 7 DEVILS AREA ABOUT TEN MILES WEST OF THE COQUILLE OPERATION. EXTENSIVE DRILLING AND LABORATORY WORK WAS EXPENDED ON THESE HOLDINGS AND SUBSTANTIAL ORE RESERVES WERE ESTABLISHED AND ADDITIONAL PROBABLE SOURCES DEVELOPED. IN A FEW MONTHS OF THIS DRILLING PROGRAM, WE PROVED UP ABOUT 150,000 TONS OF 40% EQUIVALENT Cr_2O_3 ORE WITH PROBABLE ORE INDICATED BY DRILLING OF A FURTHER 100,000 TONS. MUCH OF THE AREA HAS NOT BEEN FULLY EXPLORED. THIS 150,000 TON FIGURE WOULD CONSTITUTE A 5 YEAR SUPPLY OF ORE FOR THE COQUILLE OPERATION.

THE PROPOSED PRIMARY OR MINING PLANT HAD BEEN RATHER COMPLETELY ENGINEERED AND GROUND LAYOUT SURVEYED. THIS PLANT WOULD MINE THE DEPOSITS AND PREPARE THE HEAVY MINERAL CONCENTRATE FOR DELIVERY TO THE BENEFICIATION PLANT AT COQUILLE. MY GOOD FRIEND, DEAN GEORGE W. GLEESON, OF OREGON STATE COLLEGE, WORKED WITH US ON THIS MINING PLANT PROJECT AND WAS LARGELY RESPONSIBLE FOR

THE FLOW SHEET, PRODUCTION SCHEDULE AND PLANT LAYOUT. A COMPLETE REPORT ON THE PROJECT WAS COMPILED AND EQUIPMENT SELECTION WAS PRETTY WELL DEFINITELY FIXED.

THIS PRIMARY OR MINING PLANT WAS ENGINEERED TO MINE 750 TONS OF ORE HEAD FEED PER 16 HOUR DAY. AT A 4 TO 1 CONCENTRATION RATIO, AND FIGURING 80% RECOVERY IN THE PRIMARY PLANT, THIS WOULD GIVE 150 TONS PER DAY OF A 20% Cr_2O_3 HEAVY MINERAL CONCENTRATE FOR DELIVERY TO THE BENEFICIATION PLANT.

EXCEPT FOR THE UNEXPECTED UPSET IN PLANS, CONSTRUCTION WORK WOULD HAVE BEEN STARTED ON THIS MINING PLANT IN MARCH, 1956, TO HAVE HEAVY MINERAL CONCENTRATES AVAILABLE FOR CONTINUOUS OPERATION OF THE COQUILLE BENEFICIATION PLANT WHEN THE GOVERNMENT STOCKPILE WAS DISSIPATED IN AUGUST, 1956.

UNFORESEEN CIRCUMSTANCES FORCED THE CHROMIUM MINING AND SMELTING CORPORATION TO ABANDON THESE FUTURE DEVELOPMENT PLANS AND TO TERMINATE THEIR WORK ON COMPLETION OF PROCESSING THE GOVERNMENT STOCKPILE. ACCORDINGLY, AT THE COMPLETION, ALL OPERATIONS WERE SHUT DOWN AND THE PLANT DISMANTLED.

FROM THE EXPERIENCE GAINED IN THE BENEFICIATION OF OREGON BEACH SANDS AND WITH THE MODERN SEPARATION EQUIPMENT AND PROCESSES, WHICH HAVE BEEN PROVEN OUT, ALONG WITH INDUSTRY'S INCREASING DEMAND FOR MINERALS SUCH AS ARE FOUND IN THESE OREGON BEACH SANDS, THE FUTURE CERTAINLY IS VERY BRIGHT FOR THE REVIVING AND CONTINUATION OF THIS MINING AND BENEFICIATION INDUSTRY. OF GREAT HELP TO SUCH A PROJECT ARE THE FACTS THAT THE MINING PRACTICE FLOW SHEET HAS BEEN FAIRLY COMPLETELY ENGINEERED, THE ACTUAL MARKETING OF THE VALUE MINERALS IN THESE SANDS HAS BEEN ACCOMPLISHED, SUBSTANTIAL ORE RESERVES HAVE BEEN PROVEN AND THERE ARE UNLIMITED AREAS OF PROBABLE ORE THAT HAVE NOT YET BEEN DRILLED.

Table I

Continued Methods of Chromium and Concentration

Sample			Low Base Hyla 9	Low Base Hyla 11	Power Mine	Ophi Breck			
Header Composition, Percent Cr_2O_3			12.2	11.3	20.1	9.7			
Spigot Fractions			composites	composites	composites	1	2 (2)	3+4	
HYDRAULIC ON LEADS	High	Quantity, Percent	44.5	38.5	63.5	—	22.4	—	
	Density	Composition, Percent Cr_2O_3	27.7	27.1	27.0	—	32.3	—	
	Low	Quantity, Percent	55.5	61.5	36.5	—	77.6	—	
	Density	Composition, Percent Cr_2O_3	6.75	1.33	8.1	—	3.45	—	
	Percent Recovery, Chromium (high density)		96.7	92.5	85.3	—	73	—	
ELECTROSTATIC ON HYDRAULIC HIGH DENSITY	High	Quantity, Percent	66.0	67.6	64.0	34.3	89.8	85.2	
	Conductivity	Composition, Percent Cr_2O_3	42.1	42.3	40.5	40.6	36.8	31.7	
	Low	Quantity, Percent	34.0	32.4	36.0	15.7	10.2	14.8	
	Conductivity	Composition, Percent Cr_2O_3	0.34	0.97	3.80	0.72	1.07	0.59	
	Percent Recovery, Chromium (high density)		99.5	99.0	99.0	99.5	99.5	99.5	
Number of Separations		12 KV (+) 8 passes 12 KV (-) 10 passes	2 1	3 0	2 1	2 0	1 1	2 1	
MAGNETIC ON ELECTROSTATIC HIGH CONDUCTIVE	High Magnetic	Quantity, Percent	(4)	21.8	17.5	26.4	39.1	—	58.3
		Composition Percent	Cr_2O_3	26.7	25.2	26.3	31.1	—	24.1
			TiO_2	14.1	15.0	14.7	4.37	—	4.09
	Low Magnetic	Quantity, Percent	(4)	78.2	85.5	73.6	60.9	—	41.7
		Composition Percent	Cr_2O_3	46.4	45.2	45.6	46.7	—	42.3
			TiO_2	0.95	1.07	0.91	1.70	—	8.60
			FeO	24.6	24.7	24.4	24.3	—	26.0
			P	nil	nil	nil	nil	—	nil
			S	nil	nil	nil	nil	—	nil
			SiO_2	0.77	0.72	0.24	—	—	—
			Percent Recovery, Chromium (low magnetic)		86.2	91.2	83.0	70.2	—
	Percent Overall Recovery, Chromium (low magnetic)		83.0	83.5	70.2	—	—	—	

(1) By spigot and table classification with four spigot fractions each tabbed. The data only is composite.

(2) Composite only given for hydraulic separation. Ophi Breck spigot fractions 1, 2, 3, 4 in order of decreasing particle size are 32.9, 47.5, 16.1 and 3.4 percent by weight. The hydraulic concentrator of which are 15.4, 22.0, 33.2 and 46.5 percent of each fraction.

(3) Calculated from hydraulic separation.

(4) Calculated from compositions of magnetic heads and fractions.

(continued)

BLACK SAND STUDIES

The State Department of Geology & Mineral Industries has recognized for some time the importance of obtaining information as to the feasibility of treating the black sands of the Oregon Coast Area. Previous investigators¹ had considered gold and platinum, magnetite, or chromite and ilmenite as separate products to be considered alone; but the Department felt the economics of the various separate mineral products credited as a whole to the operation should be investigated. Table 4 presents the mineral contents of sands from several localities. As a consequence, preliminary panning tests (performed at Baker early in 1939) were conducted; but the results were not conclusive since sufficient time could not be given the matter then. Late in 1939, however, the problem was seriously considered since opportunity for such work would result from contemplated personnel changes. It has felt that magnetic or electrostatic separation would accomplish the desired results. With this in mind, several companies were contacted with regard to testing samples to be sent them.

The Ritter Products Company of Rochester, New York was selected to do the work, and a sample of black sand was sent them in December of 1939. This sample was taken from a composite of four samples from the Pioneer Mine, and the chemical analysis is given in table 1. A report dated January 3, 1940 was made on three products as follows:

Sand on 30-mesh	1.4%
Sand thru 30-mesh	98.6%

Sand thru 30-mesh:

1st Tailing	32.1%
2nd Tailing	18.5%
Concentrate	49.4%

The concentrate did not appear as clean as was desired, so a portion was panned for the elimination of gangue minerals. The chemical analyses of these three products are given below:

Table 1 Ritter Products

	Cr_2O_3 %	(Cr) %	Al_2O_3 %	Fe %	SiO_2 %	P %	TiO_2 %	Assayed by
Composite-heads	22.4	15.3	27.22	12.6	18.80	.52	5.46	
No. 1 Electrostatic Tails	25.9	17.7						
	3.8	2.6				2.6		Lancaster
No. 2 " "	5.0	3.4				3.9		Lancaster
Electrostatic Concentrate	42.7	29.2	2.8	20.1	3.1	.22	.48	Lancaster
Elect. Conc. panned magnetite-free	39.8	27.2	2.8	19.6	5.4	.17	.34	Lancaster

LOG OF 15 TON BASIC-ELECTRIC HEAT OF 17% CHROMIUM STEEL

Analysis	C	Mn	Si	S	P	Cr
Ordered	0.10 Max	0.30 to 0.50	0.30 to 0.50	0.025 max	0.025 max	16.50 to 17.50
Ladle test	0.086	0.43	0.43	0.012	0.016	17.30

TIME	ADDITIONS	REMARKS
8.10 AM		Previous heat tapped
8.20 AM	13,000 lb. ingot-iron scrap (0.03% C) 19,000 lb. stain- less scrap, 400 lb. iron ore	Began charging. 0.09% C 17.20% Cr in stainless scrap
8.50 AM		Current on high voltage
9.05 AM	300 lb. lime, 100 lb. fluor- spar, 100 lb. sand	
9.50 AM	300 lb. lime, 100 lb. fluor- spar, 100 lb sand	Current on intermediate voltage
10.25 AM		Current on low voltage
10.45 AM	150 lb. crushed silicon (75% Si)	Bath stirred
10.55 AM		Bath Stirred
11.00 AM		First test taken for analysis
11.10 AM		began slagging
11.20 AM		Finished slagging; one-half to two-thirds of slag re- moved.
11.25 AM	300 lb. lime	
11.30 AM	2500 lb. ferrochromium	0.20% C, 70.20% Cr (ferro- chromium)
11.40 AM		
12.00	2500 lb. ferrochromium	0.20% C, 70.20% Cr. (ferro- chromium)
12.30 PM		Bath stirred. Temperature tested
12.40 PM	150 lb. lime 50 lb. crushed silicon (75% Si)	
12.55 PM	95 lb. ferromanganese	0.60% C, 82.00% Mn (fer- romanganese)
1.10 PM		Bath stirred. Temperature tested
1.20 PM		Heat tapped. 190 lb. cal- cium-silicon alloy (62% Si added to ladle

LOG OF 15-TON BASIC-ELECTRIC HEAT OF LOW-CARBON 18% CHROMIUM 8%
NICKEL STEEL

Analysis	C	Mn.	Si.	S	P	Cr	Ni
Ordered	0.07 max	0.40 to 0.60	0.30 to 0.50	0.025 max	0.025 max	17.50 to 18.50	8.75 to 9.25
Ladle test	0.057	0.44	0.41	0.011	0.015	17.94	8.93

TIME	ADDITIONS	REMARKS
10.35 A M		Previous heat tapped
10.45 AM	24,000 lb. common scrap and 3100 lb. nickel	Began charging
11.05 AM		Current on high voltage (220V)
11.45 AM	300 lb. lime	Current on intermediate voltage (170V)
12.20 PM	200 lb. lime	Current on low voltage (110V)
12.30 PM	400 lb. iron ore	
12.45 PM		Bath stirred
12.50 PM		Began slagging
1.00 PM		First slag completely removed
1.10 PM	500 lb. lime, 175 lb. crushed silicon, 50 lb. fluorspar	First test taken for analysis
1.30 PM		
1.50 PM	230 lb. nickel	
2.10 PM		Bath stirred. Temperature tested
2.45 PM	3090 lb. ferrochromium	0.06% C 71.58% Cr, 0.72% Si (ferrochromium)
3.10 PM		Bath stirred. Temperature tested
3.20 PM	140 lb. ferromanganese	0.06% C, 82.00% Mn (ferro- manganese)
3.25 PM	150 lb. lime, 50 lb. crush- ed silicon (76% Si)	
3.35 PM	122 lb. lump silicon (76% Si)	
3.50 PM		Bath stirred. Temperature tested
4.00 PM		Heat Tapped

From: Alloys of Iron Monographs
Vol. II
High-Chromium
Kinzel & Franks

BLACK SAND STUDIES

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Table 4
Abstract From
"Useful Minerals in the Black Sands of the Pacific Slope"; by
D. T. Day and R. H. Richards
U.S.G.S. Mineral Resources of U.S., 1905. pp. 1175-1258
Mineral composition of black sands: Oregon pp. 1206-1214

Locality	Magnetite %	Chromite %	Ilmenite %	Olivine %	Zircon %
(Percentages referred to natural sand)					
Baker Co.					
Anthony	8.4	--	--	--	1.5
Baker City	10.4	--	38.4	--	Tr
Sumpter	10.4	--	43.2	--	Tr
Clatsop Co.					
Clatsop Beach	26.9	2.3	--	--	--
Hammond	14.2	--	6.2	--	--
Warrenton	56.2	12.8	--	16.8	.25
Hammond	59.3	7.2	--	9.2	.45
Warrenton	--	Tr	--	23.0	.35
Hammond	3.1	1.2	--	28.2	Tr
"	32.2	8.7	--	--	.25
"	34.2	8.1	--	--	.25
"	33.3	8.7	--	10.9	.3
Carnahan Sto.	Tr	Tr	--	19.0	Tr
"	Tr	Tr	--	20.0	Tr
Clatsop Spit	2.6	4.2	--	23.5	.2
Coos Co.					
Marshfield	--	8.2	--	--	.6
S. Fk Coquille R.	--	2.5	--	--	.6
Randolph Dist.	1.0	29.2	--	--	2.2
"	Tr	10.1	--	11.0	.8
Whiskey River	--	11.2	.6	--	.9
? (P 727)	3.2	23.5	11.4	--	2.7
Curry Co.					
Chetco	78.0	14.2	--	5.5	.2
Port Orford	1.5	3.5	--	45.9	.2
Rogue River	43.3	5.3	--	39.0	.1
Josephine Co.					
Waldo	--	1.1	--	--	1.4
Lincoln Co.					
Yaguna	6.2	5.3	27.0	--	4.2
"	6.1	6.4	28.6	--	3.9
Newport	8.0	6.6	33.1	--	5.3
Multnomah Co.					
Fulton	41.5	--	45.5	3.0	Tr

Prof. W. P. Blake (Am. Jour. of Sci., 2d ser., vol. 18, 1854) found that platinum could frequently be lifted by a magnet. Prof. B. Silliman (Trans A. I. M. E., vol 1, 1873) studied iridosmium content of sands. Mr. J. A. Edman (Min. & Sci. Press., N 10 '94) described mineralogy of sands and suggested shaking tables for treatment. A great deal of work was done on concentrating methods and identifications of minerals in Portland and Boston in 1905 as a preliminary study of these sands

"Electric Smelting of Magnetite from Black Sands". by

D. T. Day, C. E. Wilson, G. H. Clevenger.

Magnetite sand concentrates, coke, and limestone were smelted and produced steel in October, 1905. Difficulties of the usual experimental sort were encountered; but in spite of the negative results, the process was proven as practicable.

It was suggested to this company that the sand be screened into two sizes, and these should be treated separately. Consequently, on Feb. 7, 1940 the Department received a report as follows:

Sand on 30-mesh	1.4%
Sand thru 30-mesh retained on 60 mesh	26.4%
Sand thru 60-mesh	72.2%

	Thru 30 on 60	Thru 60
Tailing	50.3%	32.7%
Middling	19.4%	14.3%
Concentrate	30.3%	53.0%

Chemical analyses of these products were not made since the products were visually inspected and were found to be substantially the same as the previous products. In all cases, the first tailings were composed mostly of garnet, rutile, quartz, and some chromite. The concentrate were composed principally of chromite with some garnet and quartz, while the second tailings and middlings were mixtures of all minerals.

Mr. Lewis of this Department had made late in 1939 screen and chemical analyses of Pioneer samples and obtained the following results:

Table 2 - Lewis Screenings

Pioneer Samples

1. Banks
2. Tailings below sluice
3. Tailings near race
4. Average bunker sample

		1		2		3		4	
		%	Cum.	%	Cum.	%	Cum.	%	Cum.
Mesh	On								
Thru	48	3.6	3.6	7.3	7.3	8.2	8.2	15.6	15.6
48	65	27.9	34.5	27.2	34.5	25.5	33.7	32.0	47.8
65	100	50.0	84.5	52.8	87.3	52.3	86.0	44.5	92.3
100		15.5	100.0	12.7	100.0	14.0	100.0	7.7	100.0

Chromic Acid (Cr₂O₃) Analysis

		1		2		3		4	
		%	Total	%	Total	%	Total	%	Total
Mesh	On								
Thru	48	6.7	2.0						
48	65	13.8	17.4	20.2	21.2	17.5	19.5	17.7	25.0
65	100	20.4	46.5	27.4	58.1	25.8	58.7	28.3	55.5
100		28.8	19.2	29.5	14.5	29.3	17.8	27.2	9.3
Cr ₂ O ₃ Acc't'd. For		85.8		91.8		95.8		89.8	
Original		22.4		25.9		23.1		22.7	

In order to determine the chromium-iron ratio of the chromite grains, Mr. Lowell of this Department and Dr. Staples of the Department of Geology at University of Oregon handpicked from the concentrates—chromite grains. These were assayed and showed the following analyses:

Table 3 Chromite Grains

	<u>Cr₂O₃</u> <u>%</u>	<u>(Cr)</u> <u>%</u>	<u>Fe</u> <u>%</u>	<u>Assayed</u> <u>by</u>
Lowell picked gr.	41.9	28.7	18.4	Lewis
Staples picked grs.		38	19	
		46	25	Stafford

The Department acquired a laboratory electrostatic machine from Horse Heaven Mines through the courtesy of Mr. S. H. Williston. It consists of two units: the hoppers, dryer, and electrodes; and the rectifier. An inclined drying tube wound with resistance wire revolves in ball bearing suspensions by means of a geared motor. The wet feed enters the upper end through a hopper and feed roller, while the dry material drops from the lower end into another hopper. Under this hopper are located the electrostatic electrodes, one is the feed roller while the other is a brass tube of slightly larger diameter suspended on high voltage insulators in such a manner that the distance between the two electrodes may be adjusted. The roller is 1 5/16" in diameter and rotates at a speed of one revolution every eleven seconds. This roller feeds minus 65-mesh sand at the rate of 450 grams (1 lb.) per minute. A movable aluminum divider is provided for ^{dividing} products into two pans. The rectifier is a 7,500-volt full wave or 15,000-volt half-wave neon-type built by Mr. H. H. Morris for Mr. Williston. A rheostat controls the voltage impressed on the electrodes. The two units operate on 110 volt a.c. This laboratory machine was installed in the laboratory of Mr. P. R. Hines, Mining Engineer in Portland.

Johnson's² work in determining mineral conductivity showed that separations of the individual minerals was possible. It was therefore decided that in order to best determine the characteristics of the laboratory separator, Johnson's basic procedure should be followed; so the following outline for standardized tests was adopted:

- Take sample of about 2 lbs.
- Screen sample thru 35- and 65- mesh sieves (Tyler). Weigh portions.
- Take out magnetite with magnet.
- Dry in oven at 300° F for 20 minutes. (The dryer tube was dismantled because it proved a bottleneck on this material.)
- Turn on roller motor and rectifier.
- Transfer hot sample immediately to the feed hopper of the separator.
- Allow feed to run thru machine, recording conditions.

No assays were made on these products as adjustments of conditions were made on sight and on comparison with known samples.

Samples for the work conducted on this laboratory machine were obtained by Messrs. Nixon and Lowell on a field trip extending from January 27 to February 2, 1940. Description of these samples follows:

Mr. Lewis assayed these samples and obtained the following results:

- #1. Yaquina Beach. Sample consists of present beach sand from a pit, 2 feet deep, located 500 feet north of shore end of breakwater. The beach is approximately 200 feet wide by 600-800 feet long and extends some distance up the river. These shore deposits do not contain much black sand. Panning shows about 5% content of black sand.
- #2. Sample of dune sand taken 1.5 miles north of Tahkenitch Lake at U. S. Bench Mark 5G12. These sands may be a possible source of silica or glass sands. The sample location is 10.00 miles north of the north end of the Umpqua River bridge and on the west side of the highway.
- #3. The Lagoons (north of Bandon). Sample taken from material removed from a test-pit just in front of the cabins. Test-pit was apparently in black sand lense from top to bottom. Extent of lense not known, but is thought to be tailings from placer mines up the creek.
- #4. Whiskey Run Creek. Sample of beach sands at mouth of Whiskey Run Creek. Sample represents surface section of beach normal to shoreline. This sample does not contain much black sand.
- #5. U. S. Mining Co. (Ohlstead). Located north of the Pioneer Mine. The sample was taken from a well-cemented lense of at least 20 feet in thickness. The lense has considerable extent but is overlain by from 10 to 30 feet of overburden. Overburden is also firmly cemented. This channel (8" wide x 5' long) sample was taken in main pit just east of mine shed.

A sample of concentrated tailings was also collected from a pile at the mine shed.

- #6. Chickamin Mine (South Slough). Charleston, who showed us over the area.

Channel sample 8 feet long by 8 inches wide in lense of cemented black sands. The entire thickness of lense not exposed. A 35 foot tunnel follows the dip of the lense. A 35 foot hole was reported to have been drilled from the face of the tunnel without leaving the lense. There is an excellent possibility that this lense is extensive and croppings might be located by following the hill slopes in either direction from the tunnel. Excellent prospects for large tonnage.

Across the valley (to the north) is an old placer mine. The cemented lense, described in above paragraph, thins and peters out on the north side. Small boats (2' draft) can approach, by south slough, to within a 1000 feet of this location. A channel could be dredged to the prospect at no large expense. A dike across the valley prevents water from backing into the valley at high tide.

Location is 2.06 miles from junction on Seven Devils Road where the car must be left. Take left hand turn after crossing bridge and continue beyond school house 1/4 mile. Trail leads down hill to valley. Main tunnel (sampled) is almost directly across valley from old placer workings and approximately 75 feet above valley floor.

- #7. Butler Mine. 1.5 miles north of the Madden Mine on the highway. A small area (less than 100 feet across) has not been mined. The area may contain continuations of this lense, especially on west side of highway. Old workings are on east side of highway and old plant on west side.
- #8. Madden Mine. Sample was collected from channels in three sections representing a thickness of 19 feet. Samples marked: top, 5 ft.; middle, 7 ft.; and bottom, 7 ft. One sack of test material was taken from lense (5 ft. thick) 30 feet west of bridge at entrance to pit. Also a sample (channel 5 ft. long) from same lense.
- #9. Cape Blanco. Mr. Marshall, Port Orford, Oregon has a small gold recovery outfit at Cape Blanco. Handling 6 yard/day, 52% gold recovery. Three samples collected here. One of beach sands about 1/2 mile south of Marshall's setup. Another sample of beach sands at the setup, and a sample of concentrate that had passed through the sluices.
- #10. Cape Blanco Road. Sample collected from road cut just below cattle guard near end of main road. Lense 3 to 4 feet thick.
- #11. Cape Blanco Road, 3 miles from main highway. Sample from lense, at least 7 feet thick, exposed by road cut. Lense has possibility of considerable extent.
- #12. Humburg State Park entrance. Sample collected from beach on a line normal to the shoreline and just south of creek mouth.
- #13. Hunter's Creek. This sample is mostly small gravel from south side of stream and just west of the south end of the bridge. Very little black sand present. Met Mr. J. H. Turner, Gold Beach, Oregon, who has a manganese prospect near Hunter's Creek.
- #14. Myer's Creek. Sample taken near mouth of creek. Sands are not very black. The beach here has considerable extent on the north and the south of the creek.
- #15. Windchuck Creek. Property of R. W. Lemon. Sands are not very black, can drive through Lemon ranch to beach.
- #16. Mouth of Rogue River. Estate of MacCleay Beach sands are quite black. Sample taken parallel to beach and represents a considerable extent of black sand. Large tonnage available. One of best areas visited.

Mr. Lewis assayed these samples and obtained the following results:

Sample Number	Description	Cr ₂ O ₃ %	Sample Number	Description	Cr ₂ O ₃ %
1	Beach	0.5	9	1/2 mile south	24.3
3	Lagoons	21.2	9	At set-up	13.3
4	Sand	1.5	9	Concentrate	21.3
4	Lens	0.3	12	Sand	0.1
5	Lens	22.3	13	Sand	0.5
5	Concentrate	28.0	14	Sand	0.4
6	Sand	4.2	15	Sand	0.1
6	Concentrate	2.2	16	Sand	12.4
8	Bottom 5'	2.0	16	Concentrate	3.3
8	Middle 7'	1.5			
8	Top 7'	0.7			

From the above analyses it is seen that samples 3, 5, 9, and 16 show the most promise. Sample 5 is a consolidated sand, cemented with limonite. The other samples are loose sands, free of cementing material and dust. In addition to these samples, Mr. J. W. Deemy of Marshfield submitted several samples early in February, 1940. Only two of these samples were unconsolidated so they were the only ones considered. These samples are from the same locality as sample #3 "The Lagoons" taken by Nixon-Lowell.

Screen analyses of the samples considered are as follows:

Table 6

Mesh		Department		SAMPLE	
Tyler	On	#3	#16	Deemy	
Thru		%	%	5	6
				%	%
	35	6.8	1.0		0.9
35	65	44.2	60.0	38.0	28.2
65		49.0	39.0	62.0	70.9
	35				
35	48			6.3	
48	65			31.7	
65				62.0	
		<u>Magnetite</u>			
35	65		6.9		1.0
65		Tr	12.0	Tr	4.5
		<u>Concentrate</u>			
35	65		40.1		42.5
65			52.6		53.0
48	65				33.2

Sample 16 yielded 10% magnetite which assayed 56.7% iron, 4.4% silica, 0.00% phosphorous, and 4.3% titania.

Although many separate tests were made, few products were saved since they were run over and over again. Table 7 represents data on tests conducted from February 2 to 25, 1940. The purpose of this investigation was to determine the characteristics of the laboratory separator and to determine in a preliminary manner the feasibility of separating the various samples. As a consequence, conditions and adjustments were governed by the appearance of products. For all the tests recorded, the constant conditions were speed of feed, electrode gap, drying time, and stationary electrode charged positively. Preliminary experiments on the machine included changing electrode position and reversing polarity, but inherent weaknesses in the machine itself did not allow much latitude.

Two methods of attack are possible: one to make a clean tailing and a rougher concentrate in the first pass, and a middling from the rougher concentrate; or to make a clean concentrate and a rougher tailing in the first pass, and then to make a clean tailing and a middling product from the rougher tailing. The first method is the one usually employed in concentration processes and proved the better in this instance after the first few tests.

The separator is so arranged that the front of a stream of particles falling freely from the revolving feed roller just touches the divider when it is set two points to the left (L2). Zero divider is vertically under the forward face of the feed roller. Each division is $\frac{1}{4}$ inch.

Table 7 - Experimental Data

Sample	Test	Line	Voltage Regulator	Divider	Remarks
Series I: 7500 v. full-wave. Electrode gap 3/4" wave, centers level					
Ritter Head	1	115	10	L 4	Clean tail) As good as Ritter
	2	120	17 1/2	L 2	Clean Conc.) Slightly better.
N-L 3	3	120	17 1/2	L 1 1/2	Good red tail
	4	96	0	L 3	Some black in tail, red in conc.
	5	115	10	L 3	No better
N-L 5	6	96	0	L 3	Too much dust-
	7	106	5	L 3	Washed sand - still dust
	8	114	10	L 3	" again - no improvement
	9	119	15	L 3	" " " "
N-L 16	10	96	0	L 3	Small black in red tails
	11	120	17 1/2	0	" " " " "
	14	106	5	R 2	Much red in concentrate
N-L 3	12	96	0	L 4	Black in Tails
	13	114	10	R 1	Red in conc.
	15	120	17 1/2	L 2	Fair balance
	16	119	17 1/2	L 1 1/2	No better
	17	120	17 1/2	L 1 1/2	No better
Series II: 15,000 v. in half-wave. Electrode gap 3/4" wave centers level					
N-L 3	35	92	0	L 3	1st Tail
	36	104	5	L 2 1/2	Not too clean
	40	120	17 1/2	L 2 1/2	Cleaner conc.
N-L 16	37	100	5	L 2	Few small black in tails
	38	100	5	L 1 1/2	Fewer black in tails
	39	100	5	L 1 1/2	Still fewer black
Deemy 5	47	100	5	L 1	Some red to right
	48	100	5	0	Little red to right
-48-65	49	100	5	R 1	Black to left
	50	100	5	0	10 passes for conc.
Deemy 5	64	100	5	L 3	Black to right
	65	100	5	R 3	Still black in left
-65	69	100	5	L2-R2(Two)	Black lt and rt. red middle
	75	100	5	R 1	Red close to divider
	76	100	5	L 1	Red close to divider
Deemy 6	77	100	5	L 4	Wh & bl left, bl and wh right
	78	100	5	L 2 1/2	Red to left
-35-65	82	100	5	R 3	Wh & bl right, too much to left.
	86	100	5	L 2 1/2	Fair rougher middling
	87	100	5	L 3 1/2	5 passes, good conc.
Deemy 6	89	100	5	L 4	Black conc.
	96	100	5	L 1	About same grade
-65	97	100	5	R 2	Red tail, Middling 7 passes
	105	100	5	L 4	Good conc.

Test 6, 7, 8, and 9 - Sample 5 contains considerable dust even after washing several times. Dust coats particles; and since surface conditions control separation, all particles are acted upon equally. This, therefore, does not lend itself readily to separation.

Test 10 - 10% magnetite taken out.

Test 69 - A compound divider was installed.

Test 77 - The plus 65-mesh material contains considerable coarse quartz so that screening results in a partial concentration in the -65-mesh material.

CONCLUSIONS ON EXPERIMENTAL WORK

This investigation has shown the unconsolidated sands amenable to electrostatic separation. In order to avoid changing too many factors and since they are difficult to adjust, the electrodes were set and not changed. With this setting good rougher concentrates were obtained, but better concentrates would result if rougher concentrates would be re-treated in a machine with different electrode positions. Commercial machines are built with several electrodes in a cascading arrangement so that several products are produced with the varying conditions thus obtained.

Although these studies have shown the feasibility of electrostatic separation, it is probable the process would be more efficiently operated as a combination of several methods - magnetic, electrostatic, and screen, air, or water classification.

* * * * *

Electrostatic separation during the past few years has not found application to any great extent in the minerals separation field. However, around 1910-17, several plants were in operation treating zinc-lead table and jig concentrates. The notable example was the Midvale plant of the U. S. Smelting Company in Utah. This concentrator treated for several years close-bracketed screened mixtures of sphalerite and galena, but the advent of flotation altered the picture; and the plant was dismantled. The exciting unit, a 3-horsepower motor-driven mechanical rectifier producing 18,000 to 22,000 volts, treated 65 tons per day at a cost of \$2.10 per ton. The following table presents estimated costs of electrostatic and magnetic operation.

Table 8

ESTIMATED COST OF ELECTROSTATIC SEPARATION

(H. B. Johnson: Electrostatic Separation. E & M J D'38 p. 44)

Assumed:

Plant operates 24 hours per day, 300 days per year
 Supervision, per hour \$0.75
 Power, per kw-hr. 0.02
 Fixed charges, 10% of installed value.

Tons per hour	5	25	50
Tons per year	36,000	180,000	360,000
Separating equipment installed	\$9,000	\$39,700	\$79,400
Drying equipment installed	\$10,000	\$22,500	\$40,000
(Double-shell indirect-heat)			

Charges:	per ton	per ton	per ton
Fixed (Amortization)	\$0.025	\$0.022	\$0.022
Power	.012	.006	.004
Supervision	.150	.030	.015
Repairs, supplies, maintenance etc.	.007	.007	.007
Total Separating Cost per ton	\$0.194	\$0.065	\$0.048
Fixed (Amortization)	\$0.042	\$0.019	\$0.017
Operating expenses	.304	.144	.093
Total Drying Cost per ton	\$0.346	\$0.163	\$0.110
TOTAL OVERALL COST	\$0.540	\$0.228	\$0.158

MAGNETIC CONCENTRATION COSTS, IC 6624 P. 2 & 4 Witherbee, Sherman & Co., Mineville, N. Y.

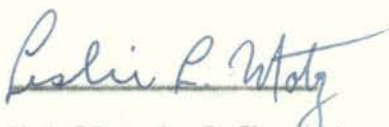
Operating in 1930 at hourly capacity of 100 tons

Charges:	
Fixed and superintendence	\$0.069
Power	.070
Transporting, elevating	.194
Drying (Shaft furnace)	.061
TOTAL ACTUAL OVERALL COST	\$0.394

References:

1. Day and Richards: "Useful Minerals in the Black Sands of the Pacific Slope: U. S. G. S. Mineral Resources of the U. S., 1905
Pardee: Beach Placers of the Oregon Coast; U. S. G. S. Circular 8. (1934).
Hornor: Notes on the Black Sand Deposits of Southern Oregon and Northern California; U. S. Bureau of Mines, Tech. Paper 196. (1918).
2. Johnson: Selective Electrostatic Separation; A. I. M. E. Milling Methods, 1939.
Johnson: Electrostatic Separation; E. & M. J., Oct., Nov., Dec., 1938.

Portland, Oregon
February 28, 1940


Metallurgical Chemist



STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

STATE ASSAY LABORATORY
402 EAST I STREET
GRANTS PASS, OREGON

February 13, 1940

Mr. Earl K. Nixon, Director
State Department of Geology and
Mineral Industries
c/o Mayflower Hotel
Washington, D. C.

Following are the results of the chromium determinations
made on the samples of sand from the Oregon coast:

<u>Office number</u>	<u>Sample number</u>	<u>Description</u>	<u>Chromic Oxide percent</u>
AG 148	1	Yakuina Beach	0.5
AG 149	3	Lagoons ←	<u>21.2</u>
AG 150	4A	Whisky Run, beach sand	1.5
AG 151	4B	Whisky Run, lens sample	0.3
AG 152	5B	U.S. Mining Co. (Ohlmstead) Concentrate	26.0
AG 153	5A	U.S. Mining Co. (Ohlmstead) 20 ^{inches} feet seam	22.3
AG 154	6A	South Slough <i>Sw. Ritter</i>	4.2
AG 155	6B	South Slough, concentrate (<i>high in magnetite</i>)	2.2
AG 156	8A	Madden Mine, bottom 5 feet, main pit	2.0
AG 157	8C	Madden Mine, top 7 feet, main pit	0.1
AG 158	8B	Madden Mine, middle 7 feet, main pit	1.5
AG 159	9C	Cape Blanco, conc't from Marshall set-up	21.3
AG 160	9A	Cape Blanco, farthest S. on beach from Marshall	<u>24.3</u>
AG 161	9B	Cape Blanco, Marshall set-up, beach sand	<u>13.3</u> ✓
AG 162	12	Humbug State Park entrance north, mouth of creek	0.1

(Chromium determinations continued)

<u>Office number</u>	<u>Sample number</u>	<u>Description</u>	<u>Chromic Oxide percent</u>
AG 163	13	Hunters Creek	0.5
AG 164	14	Mouth of Myers Creek, 100 yards south	0.4
AG 165	15	Mouth of Wind chuck	0.1
AG 166	16 A	Gold Beach sand as taken	0.7 12.4 ✓
AG 167	16 B	Gold Beach sand, jig concentrate	3.3

Respectfully submitted... *Albert A. Lewis*...

Albert A. Lewis
Analyst

CLASS OF SERVICE

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R. B. WHITE
PRESIDENT

NEWCOMB CARLTON
CHAIRMAN OF THE BOARD

J. C. WILLEVER
FIRST VICE-PRESIDENT

WESTERN UNION

1201

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1940 FEB 15 PM 11 36

CA734 35 NT=EUGENE ORG 15

EARL K NIXON=

MAYFLOWER HOTEL WASHDC=

ANALYSIS OF LESS THAN 1/10 GRAM GIVE CHROMIUM IRON RATIO

198-100 AGAINST THEORETICAL 187-100 STOP ABOUT 38%

ELEMENTAL CHROMIUM AND 19% ELEMENTAL IRON COMPARED TO ABOUT

46 CHROMIUM AND 25 IRON=

O F STAFFORD.

1.8411

1/10 198-100 187-100 38% 19% 46 25.

RECEIVED
FEB 16 1940

STATE DEPT OF GEOLOGY
& MINERAL INDS.

Night Letter

Feb. 15, 1940.

Mr. Earl K. Nixon
Mayflower Hotel
Washington, D. C.

ANALYSIS OF LESS THAN ONE-TENTH GRAM GIVES CHROMIUM IRON
RATIO ONE NINETY EIGHT TO ONE HUNDRED AGAINST THEORETICAL
ONE EIGHTY SEVEN TO ONE HUNDRED. STOP. ABOUT THIRTY-EIGHT
PER CENT ELEMENTAL CHROMIUM AND NINETEEN PER CENT ELEMENTAL
IRON COMPARED TO ABOUT FORTY-SIX CHROMIUM AND TWENTY-FIVE IRON.

O. F. Stafford

Cr	Fe
198	100
187	100
38%	19%
46%	25%

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CHAIRMAN OF THE BOARDJ. C. WILLEVER
FIRST VICE-PRESIDENT

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Received at

PZ46 53 COLLECT DL XC=GRANTSPASS ORG 8 436 P 1940 FEB 8 PM 4 46

EARL K NIXON= C 122

329 SOUTHWEST OAK ST PORTLAND ORG=

SAMPLES RECEIVED IN MAIL SMALL 41.9 CHROMIC OXIDE 18.4 IRON
LARGE 45.6 CHROMIC OXIDE FOLLOWING ARE PERCENT CHROMIC OXIDE
NUMBER 3 LAGOONS 21.2 NUMBER 5 US MINING COMPANY CONCENTRATE
26.0 NUMBER 6 SOUTH SLOUGH 4.2 NUMBER 16 GOLDBEACH SAND
12.4 CONCENTRATE 3.3 NUMBER 8 MADDEN MINE BOTTOM 5 FEET
MAIN PIT 2.0=

ALBERT A LEWIS.

RECEIVED
FEB 8 1940

STATE DEPT OF GEOLOGY
& MINERAL INDS.

February 8, 1940

BACK BEACH CHROME SANDS

	<u>Original</u> %	<u>Electrostatic Concentrate</u> %
Chromic Oxide	22.4 to 25.9	42.7
Silica	18.80	
Alumina	27.22	
Ferric Oxide	18.00	
Titanium Dioxide	5.46	.48
Phosphorous	.52	

CHARLTON

ANALYSES

PHONE BEACON 2070



LABORATORIES

CONSULTATION

2340 S.W. JEFFERSON ST., PORTLAND, ORE.

Feb. 13, 1940 - Ref. #1974

LABORATORY REPORT

SAMPLE #16 Black Sand "Magnetite"
100 mesh

RECEIVED Feb. 9, 1940

FROM Ore. State Dept. of
Geology & Mineral Industries

MARKS

ANALYSIS

Silica (SiO_2)	4.4%
Iron (Fe)	56.7%
Phosphorus	0.00%
Titanium (as TiO_2)	4.3%

RECEIVED
FEB 14 1940

STATE DEPT OF GEOLOGY
& MINERAL INDS.

REMARKS:

*Assays
Chrome*

By

J. M. Long

CHARLTON

ANALYSES

PHONE BEACON 2070



LABORATORIES

CONSULTATION

2340 S.W. JEFFERSON ST., PORTLAND, ORE.

Jan. 29, 1940 - Ref. # 1925

LABORATORY REPORT

SAMPLE 2 sand samples

RECEIVED Jan. 17, 1940

FROM Oregon State Department of
Mining and Geology
MARKS Samples marked No. 1 and No.

ANALYSIS

Sample No. 1 *Panned Concentrate* Titanium (as TiO_2) 0.34%

Sample No. 2 *Electrostatic* Titanium (as TiO_2) 0.48%

RECEIVED
JAN 30 1940

STATE DEPT. OF GEOLOGY
& MINERAL INDUS.

REMARKS:

*Kindly make out
voucher to cover
attached bill.*

By

John M. Hays
JME

STATE GOVERNING BOARD
W. H. STRAYER, CHAIRMAN, BAKER
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E. B. MACNAUGHTON . . PORTLAND

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DIRECTOR
ARTHUR M. SWARTLEY
CONSULTING MINING ENGINEER
RAY C. TREASHER
GEOLOGIST
F. W. LIBBEY
MINING ENGINEER



STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

329 S. W. OAK STREET
PORTLAND, OREGON
Feb. 9, 1940.

STATE ASSAY LABORATORIES
402 E. 1 ST., GRANTS PASS
J. E. MORRISON
MINING GEOLOGIST
ALBERT A. LEWIS
ANALYST
2102 COURT ST., BAKER
JOHN ELIOT ALLEN
FIELD GEOLOGIST
LESLIE L. MOTZ
ANALYST

Replies should be
addressed c/o State
Assay Laboratory
2102 Court St.,
Baker, Oregon

RECEIVED
FEB 10 1940

STATE DEPT OF GEOLOGY
& MINERAL INDS.

Mr. Earl K. Nixon
Director
Dept. Geology & Mineral Industries
329 SW Oak St.
Portland, Ore.

Dear Mr. Nixon:

Enclosed are the analytical results
for the electrostatic samples.

As Leslie probably told you, I had
a touch of the "flu" last week and did
practically no laboratory work. Sorry I
caused this delay. Mr. Libbey's sample will
be in the mail tomorrow.

Sincerely,

Hugh
Hugh H. Lancaster,
Assayer

Assayed
n

STATE DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

ASSAY REPORT

Office Number _____

Grants Pass, Oregon
Baker, Oregon

Feb; 9, 1934.

Sample submitted by Electrostatic samples Portland Office.

Sample description AB102 Electrostatic conc. AB103 Panned conc. Magnetite free.

AB104 #1 Electrostatic tails. AB105 #2 Electrostatic tails.

The assay results given below are made without charge as provided by Chapter 176, Section 10, Oregon Laws 1937, the sender having complied with the provisions thereof.

NOTICE: The assay results given below are from a sample furnished by the above named person. This department had no part in the taking of the sample and assumes no responsibility, other than the accuracy of the assay of the material as furnished it by the sender.

Al2O3			Iron		Silica	Cr.	Cr2O3	phos.	Total Value
Sample Number	% GOLD		% SILVER						
	Ounces per ton	Value	Ounces per ton	Value	Percent	percent Value	Percent	percent Value	
AB102	2.8		20.1		3.1	29.2	42.7	.22	
AB103	2.6		19.6		5.4	27.2	39.8	.17	
AB104						2.6	3.8	.26	
AB105						3.4	5.0	.39	

Market Quotations:

Gold \$ per oz.
Silver \$ per oz.
 \$ per oz.
 \$ per oz.

STATE ASSAY LABORATORY

Hugh K. Lancaster
Assayer

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PRESIDENTNEWCOMB CARLTON
CHAIRMAN OF THE BOARDJ. C. WILLEVER
FIRST VICE-PRESIDENT

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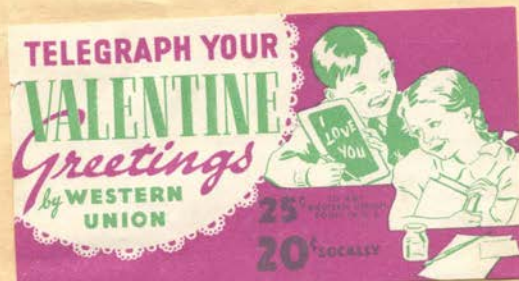
GK13 15 COLLECT XC=BAKER ORG 8 1015A 1940 FEB 8 AM 10 18

EARL K NIXON= C 53 74-004

329 SOUTHWEST OAK ST PORTLAND ORG=

CHROME OXIDE PERCENT TAILS ONE 3.8 TWO 5.0 ELECTROSTATIC (CONCENTRATE 42.7 PANNED CONCENTRATE 39.8=

HUGH K LANCASTER.



5.8 5.0 42.7 39.8

ECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

STATE GOVERNING BOARD

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



EARL K. NIXON
DIRECTOR

ARTHUR M. SWARTLEY
CONSULTING MINING ENGINEER

RAY C. TREASHER
GEOLOGIST

F. W. LIBBEY
MINING ENGINEER

STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

329 S. W. OAK STREET
PORTLAND, OREGON

Feb. 8, 1940.

STATE ASSAY LABORATORIES

402 E. 1 ST., GRANTS PASS

J. E. MORRISON
MINING GEOLOGIST
ALBERT A. LEWIS
ANALYST

2102 COURT ST., BAKER

JOHN ELIOT ALLEN
FIELD GEOLOGIST
LESLIE L. MOTZ
ANALYST

Replies should be
addressed c/o State
Assay Laboratory
2102 Court St.,
Baker, Oregon

RECEIVED
FEB 9 1940

STATE DEPT OF GEOLOGY
& MINERAL INDS.

Mr. Earl K. Nixon
Director
Dept. Geology & Mineral Industries
329 SW Oak St.
Portland, Ore.

Dear Mr. Nixon:

The percent silica in the electrostatic concentrate is 3.1 and in the pan concentrate 5.4. The phosphorus in all of the samples is in the neighborhood of a few hundredths of 1%.

The precipitate was so small at first that I believed there was no phosphorous. The rest of the analyses will be done tonight. I will wire the results in the morning.

Sincerely,

Hugh K. Lancaster
Hugh K. Lancaster,
Assayer

M.Y.

Black Sand Concentrate

E. W. LAZELL, PH. D.
CHEMICAL AND EFFICIENCY ENGINEER
CHEMICAL AND PHYSICAL LABORATORIES
537 RAILWAY EXCHANGE BUILDING
PORTLAND, OREGON

Dec. 26, 1939

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

Attention Mr. Earl K. Nixon

Dear Sir:

I report the analysis of a sample of Chromite ore
submitted.

Laboratory No. 40885 - Composite of equal amounts 4 samples.

Silica - - - - -	18.80%
Alumina - - - - -	27.22
Iron Oxide as Ferric - - -	18.00
Titanium Dioxide - - - - -	5.46
Phosphorus - - - - -	.52

Respectfully submitted,

E. W. Lazell

2cc

Analysis
M

E. W. LAZELL, PH. D.
CHEMICAL AND EFFICIENCY ENGINEER
CHEMICAL AND PHYSICAL LABORATORIES
537 RAILWAY EXCHANGE BUILDING
PORTLAND, OREGON

Dec. 26, 1939

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

Attention Mr. Earl K. Nixon

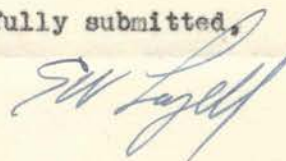
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Phosphorus - - - - -	.52

Respectfully submitted,



2cc

STATE GOVERNING BOARD

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RAY C. TREASHER
GEOLOGIST

F. W. LIBBEY
MINING ENGINEER



STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

329 S. W. OAK STREET
PORTLAND, OREGON

STATE ASSAY LABORATORY
402 East I Street
Grants Pass, Oregon

STATE ASSAY LABORATORIES
402 E. I ST., GRANTS PASS

J. E. MORRISON
MINING GEOLOGIST
ALBERT A. LEWIS
ANALYST

2102 COURT ST., BAKER
JOHN ELIOT ALLEN
FIELD GEOLOGIST
LESLIE L. MOTZ
ANALYST

RECEIVED
NOV 20 1939

STATE DEPT OF GEOLOGY
& MINERAL INDS,

November 18, 1939

Mr. Earl K. Nixon, Director
State Department of Geology and
Mineral Industries
329 S. W. Oak Street
Portland, Oregon

Dear Mr. Nixon:

Enclosed are more assay results on the beach sand samples.

A small portion of each screen size from sample 1 and of each of the three finer products from samples 2, 3 and 4 was ground in a small agate mortar to minus 100-mesh. The assays were made on these finely ground portions rather than on the whole sand grains.

Mr. Lancaster and his wife stopped in to see me on their way to Portland and I was glad that I had a chance to meet him.

Very truly yours,

Albert A. Lewis

Albert A. Lewis
Analyst

al

Chronicle



STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

STATE ASSAY LABORATORY

402 EAST I STREET
GRANTS PASS, OREGON

November 18, 1939

BEACH SAND REPORT CONTINUED:

PARTIAL ANALYSES OF BEACH SAND SAMPLES

SAMPLE	1		2		3		4	
	Per- cent Cr_2O_3	Percent of total Cr_2O_3	Per- cent Cr_2O_3	Percent of total Cr_2O_3	Per- cent Cr_2O_3	Percent of total Cr_2O_3	Per- cent Cr_2O_3	Percent of total Cr_2O_3
Original	22.4	100.0	25.9	100.0	23.1	100.0	22.7	100.0
On 48	6.7	2.0						
Thru 48 on 65	13.8	17.4	20.2	21.2	17.5	19.3	17.7	25.0
Thru 65 on 100	20.4	46.5	27.4	56.1	25.9	58.7	28.3	55.5
Thru 100	28.8	19.9	29.5	14.5	29.3	17.8	27.2	9.3
Total Cr_2O_3 acc't for		85.8		91.8		95.8		89.8

Signed... *Albert C. Lewis* ...
Analyst

November 8, 1939

Mr. Albert A. Lewis, Assayer
State Assay Laboratory
Grants Pass, Oregon

Dear Al:

Thanks for your report of November 7th on the chrome sands.

It looks like you did a good job.

I am very much encouraged by the high percentage of chromic oxide contained in these samples. I believe you had better run screened portions below 48 mesh on each of the four samples for chromic oxide, that is to say, the 48-65, the 65-100, and the -100 mesh. That would be three assays for each of the samples, Nos. 1, 2, 3, and 4. I would not bother with the -48 mesh for the time because there is such a small percentage of it. The three portions of each sample of -48 mesh I would run without further pulverizing if you can do this, because, as you noted, the iron and consequently the chrome content will be affected if you try to pulverize.

With best wishes, I am

Sincerely yours,

EKN:vm

Director

STATE GOVERNING BOARD

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

EARL K. NIXON
DIRECTOR

ARTHUR M. SWARTLEY
CONSULTING MINING ENGINEER

RAY C. TREASHER
GEOLOGIST

F. W. LIBBEY
MINING ENGINEER



STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

329 S. W. OAK STREET
PORTLAND, OREGON

STATE ASSAY LABORATORIES

402 E. 1 ST., GRANTS PASS

J. E. MORRISON

MINING GEOLOGIST

ALBERT A. LEWIS

ANALYST

2102 COURT ST., BAKER

JOHN ELIOT ALLEN

FIELD GEOLOGIST

LESLIE L. MOTZ

ANALYST

RECEIVED
NOV 8 1939

STATE DEPT. OF GEOLOGY
& MINERAL INDS.

STATE ASSAY LABORATORY
400 East I Street
Grants Pass, Oregon

November 7, 1939

Mr. Earl K. Nixon, Director
State Department of Geology and
Mineral Industries
329 S. W. Oak Street
Portland, Oregon

Dear Mr. Nixon:

Enclosed are the assay results that I have to date on the beach sand samples. I will send the assay results on the different screen sizes as soon as possible. Following is a comparison of assays on the same sample:

	<u>Percent Cr₂O₃</u>
By Ralph Mason (Byram's chemist)	52.55
By Albert A. Lewis, State Assayer	51.02
	51.34

I will do some more checking with Mason and see if this can be improved. I should be able to check their results to 0.5 percent at least.

Very truly yours,

Albert A. Lewis

Albert A. Lewis
Assayer

al



STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

STATE ASSAY LABORATORY
402 EAST I STREET
GRANTS PASS, OREGON

November 7, 1939

RECEIVED
NOV 8 1939

STATE DEPT. OF GEOLOGY
& MINERAL INDS.

Following is a preliminary report on four samples of beach sand from the Pioneer Mine, located approximately 7 miles North of Bandon, Oregon:

Four samples of sand, weighing approximately 100 lbs. each, were submitted to the State Assay Laboratory in Grants Pass by Mr. Earl K. Nixon and Mr. Ray Treasher. The four samples were dried and from each, a 10 lb. sample was taken with a Jones-type, riffle sampler. These samples were retained at the State laboratory for assaying and examination.

More than 50 percent of the sand grains are grains of metallic oxides; the remaining portion consisting of garnet, quartz and other non-metallic minerals. A very small percentage of the sand grains is attracted by either an ordinary horseshoe magnet or an electromagnet. Following are the sample descriptions:

No. 1. Bank sample. No. 2. Tailings from below sluice.
No. 3. Tailings from near race. No. 4. Average sample from bunker.

ASSAY RESULTS ON ORIGINAL MATERIAL

<u>No.</u>	<u>Gold</u> <u>oz./T.</u>	<u>Silver</u>	<u>Platinum</u>	<u>Chromic</u> <u>oxide</u>
1	0.01	Trace	Trace	22.41
2	Trace	Blank	Blank	25.89
3	0.04	Trace	Trace	23.05
4	0.06	Trace	Trace	22.66

BEACH SAND REPORT CONTINUED

SCREEN ANALYSES

1500 gram portions of samples 1, 2, and 3 and 1300 grams of sample number 4 were screened on Tyler Standard Screens with the following results:

<u>Screen Size</u>	<u>1</u>		<u>2</u>		<u>3</u>		<u>4</u>	
	<u>Per-</u> <u>cent</u>	<u>Percent</u> <u>cum.</u>	<u>Per-</u> <u>cent</u>	<u>Percent</u> <u>cum.</u>	<u>Per-</u> <u>cent</u>	<u>Percent</u> <u>cum.</u>	<u>Per-</u> <u>cent</u>	<u>Percent</u> <u>cum.</u>
on 48	6.6	6.6	7.3	7.3	8.2	8.2	15.8	15.8
Thru 48 on 65	27.9	34.5	27.2	34.5	25.5	33.7	32.0	47.8
Thru 65 on 100	50.0	84.5	52.8	87.3	52.3	86.0	44.5	92.3
Thru 100	15.5	100.0	12.7	100.0	14.0	100.0	7.7	100.0

Signed.....*Albert G. Lewis*.....
Analyst

BLACK SANDS

Pioneer Samples

1. Banks
2. Tailings below sluice
3. Trailings near race
4. Average bunker sample

		Screen Analysis							
		1		2		3		4	
Mesh	On	%	% Cum.	%	% Cum.	%	% Cum.	%	% Cum.
Thru	48	6.6	6.6	7.3	7.3	8.2	8.2	15.8	15.8
48	65	27.9	34.5	27.2	34.5	25.5	33.7	32.0	47.8
65	100	50.0	84.5	52.8	87.3	52.3	86.0	44.5	92.3
100		15.5	100.0	12.7	100.0	14.0	100.0	7.7	100.0

Chromic Acid (Cr₂O₃) Analysis

		1		2		3		4	
Mesh	On	%	% Total	%	% Total	%	% Total	%	% Total
Thru	48	6.7	2.0						
48	65	13.8	17.4	20.2	21.2	17.5	19.3	17.7	25.0
65	100	20.4	46.5	27.4	56.1	25.9	58.7	28.3	55.5
100		28.8	<u>19.2</u>	29.5	<u>14.5</u>	29.3	<u>17.8</u>	27.2	<u>9.3</u>
Cr ₂ O ₃ Acc't'd. for			85.8		91.8		95.8		89.8
Original		22.4		25.9		23.1		22.7	

Coast Trip to Collect Chromite Sand Samples

Speedometer reading at Portland--4310 miles.

Samples collected:

- #1. Yaquina Beach. Sample consists of present beach sand from a pit, 2 feet deep, located 500 feet north of shore end of breakwater. The beach is approximately 200 feet wide by 600-800 feet long and extends some distance up the river. These shore deposits do not contain much black sand. Panning shows about 5% content of black sand.
- #2. Sample of dune sand taken 1.5 miles north of Tahkenitch Lake at U. S. Bench Mark 5G12. These sands may be a possible source of silica or glass sands. The sample location is 10.00 miles north of the north end of the Umpqua River bridge and on the west side of the highway.
- #3. The Lagoons (north of Bandon). Sample taken from material removed from a test-pit just in front of the cabins. Test-pit was apparently in black sand lense from top to bottom. Extent of lense not known, but is thought to be tailings from placer mines up the creek. 21.2%

(Note: Send Mr. Shipley copies of the photographs taken by Mr. Nixon and Mr. Treasher on their trip down the coast. Mr. Shipley, Pioneer Mine, Bullards, Oregon.)

- #4. Whiskey Run Creek. Sample of beach sands at mouth of Whiskey Run Creek. Sample represents surface section of beach normal to shoreline. (Mr. Louie Kibele, 84 years old, Bullards P. O., Oregon, knows old history of area and sand localities. Claims existence of black sand lenses several hundred yards from present shoreline and covered by 50 to 60 feet of overburden.) This sample does not contain much black sand.

- #5. U. S. Mining Co. (Ohlmstead). Located north of the Pioneer Mine. The sample was taken from a well-cemented lense of at least 20 feet in thickness. The lense has considerable extent but is overlain by from 10 to 30 feet of overburden. Overburden is also firmly cemented. This channel (6" wide x 5' long) sample was taken in main pit just east of mine shed. 26% conc.

A sample of concentrated tailings was also collected from a pile at the mine shed.

Note: 6 miles of Bullards, Oregon.

The drainage from the Rose Mine and two unnamed mines is concentrated in an unnamed creek, just north of Whiskey Run Creek. This creek flows in a cleared, wide, flat valley. This location might present an excellent prospective dredging or shovel area for recovery of black sand concentrates.

- #6. Chickamin Mine (South Slough). Met Mr. Bill Wilson, Charleston, who showed us over the area. 42%

Channel sample 8 feet long by 6 inches wide in lense of cemented black sands. The entire thickness of lense not exposed. A 35 foot tunnel follows the dip of the lense. A 35 foot hole was reported to have been drilled from the face of the tunnel without leaving the lense. There is an excellent possibility that this lense is extensive and croppings might be located by following the

hill slopes in either direction from the tunnel. Excellent prospects for large tonnage.

Across the valley (to the north) is an old placer mine. The cemented lense, described in above paragraph, thins and peters out on the north side. Small boats (2' draft) can approach, by South Slough, to within a 1000 feet of this location. A channel could be dredged to the prospect at no large expense. A dike across the valley prevents water from backing into the valley at high tide.

Location is 2.06 miles from junction on Seven Devils Road where the car must be left. Take left hand turn after crossing bridge and continue beyond school house 1/4 mile. Trail leads down hill to valley. Main tunnel (sampled) is almost directly across valley from old placer workings and approximately 75 feet above valley floor.

- #7. Butler Mine. 1.5 miles north of the Madden Mine on the highway. A small area (less than 100 feet across) has not been mined. The area may contain continuations of this lense, especially on west side of highway. Old workings are on east side of highway and old plant on west side.
- #8. Madden Mine. Sample was collected from channels in three sections representing a thickness of 19 feet. Samples marked: top, 5 ft.; middle, 7 ft.; and bottom, 7 ft. One sack of test material was taken from lense (5 ft. thick) 30 feet west of bridge at entrance to pit. Also a sample (channel 5 ft. long) from same lense. ← 2.0%
- #9. Cape Blanco. Mr. Marshall, Port Orford, Oregon, has a small gold recovery outfit at Cape Blanco. Handling 6 yards/day, 52% gold recovery. Three samples collected here. One of beach sands about 1/2 mile south of Marshall's setup. Another sample of beach sands at the setup, and a sample of concentrate that had passed through the sluices.
- Fossil-bone (whale vertebra), silicified wood, and a rounded stone brought back from beach.
- #11. Cape Blanco Road, 3 miles from main highway. Sample from lense, at least 7 feet thick, exposed by road cut. Lense has possibility of considerable extent.
- #10. Cape Blanco Road. Sample collected from road cut just below cattle guard near end of main road. Lense 3 to 4 feet thick.
- #12. Humbug State Park entrance. Sample collected from beach on a line normal to the shoreline and just south of creek mouth.
- #13. Hunter's Creek. This sample is mostly small gravel from south side of stream and just west of the south end of the bridge. Very little black sand present. Met Mr. J. H. Turner, Gold Beach, Oregon, who has a manganese prospect near Hunter's Creek.
- #14. Myer's Creek. Sample taken near mouth of creek. Sands are not very black. The beach here has considerable extent on the north and the south of the creek.
- #15. Windchuck Creek. Property of R. W. Lemon. Sands are not very black. Can drive through Lemon ranch to beach.
- #16. Mouth of Rogue River. Estate of MacCleay Beach sands are quite black. Sample taken parallel to beach and represents a considerable extent of black sand. Large tonnage available. One of best areas visited. Cr. 03
12.4%

RECORD OF SAMPLES OF BLACK SAND MATERIAL
SUBMITTED TO
STATE DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES

Sample No. 1 - This material taken from Section 13, Township 26, Range 14, and the deposit of the sand runs from 3 to 15 feet; width and length of the deposit unknown.

Sample No. 2 - This material taken from Section 25, Township 26, Range 14; depth of the deposit 3 to 25 feet in thickness; width 150 to 300 feet; length unknown.

"Chickamin"

Sample No. 3 - This material taken from Section 26, Township 26, Range 14; depth of the deposit 3 to 12 feet; width 100 to 300 feet and length estimated at 1500 feet.

Sample No. 4 - This material taken from Section 21, Township 27, Range 14; depth of deposit 3 to 15 feet, width 100 to 300 feet; length not known.

Sample No. 5 - This material taken from Section 33, Township 27, Range 14; depth of the deposit 3 to 12 feet; width 50 to 300 feet; length unknown.

Sample No. 6 - This material taken from a lagoon or old lake bed in Section 32, Township 27, Range 14, and the quantity or extent of the deposit seems unlimited.

Lagoons

Sample No. 7 - This material taken from Section 4, Township 28, Range 14 and is 3 to 20 feet in thickness; width and length of deposit not known.

All of the above samples of material were taken from properties described above in western Coos County. Samples were gathered without extensive investigation and are merely suggestive of the general character of the material existing in the described locations.

A map designating approximate locations submitted herewith.

May 15, 1940

Dr. O. F. Stafford
Department of Chemistry
University of Oregon
Eugene, Oregon

Dear Doctor Stafford:

I note, on returning from a journey, your letter of April 5th and Mr. Motz' reply of April 9th. These communications pertain to the contemplated cooperative work on black sands.

The U. S. Geological Survey has changed its attitude somewhat and have really agreed to do some preliminary work in the field, perhaps followed by some drilling they might be able to wangle from the U. S. Bureau of Mines out of the Strategic Minerals appropriation. I understand that Francis Wells of the U.S.G.S. will be in this office shortly for discussion of the problem. After talking with him, I will be in a better position to go further into the matter with you.

With best wishes, I am

Sincerely yours,

EKN:vm

Director

April 9, 1940

Professor O. F. Stafford,
Department of Chemistry,
University of Oregon,
Eugene, Oregon.

Dear Dr. Stafford:

Thank you for your letter of April 5th., and I am also acknowledging your letter of March 26th. Mr. Nixon has gone to Peru and probably will not be back until the first week in May.

I am afraid I am as much at sea or out on a limb as you are in regard to this black sand analysis work. Mr. Gleeson was in town yesterday, but he was only interested in, and only knew about, the laboratory testing part of the deal, so I am afraid we will have to let things ride until more definite information is available. I will certainly advise you when we expect Mr. Nixon.

As I understand it, the A.I.M.E. is having a meeting in Eugene, so we really ought to be able to get together on the whole matter.

As to your letter of March 26th, inclosing the talk on quicksilver, Mr. Nixon left in such a hurry that he did not get time to give it its due attention. I have read it and think it is very good - you certainly presented all the information that was needed to such an unknown and probably widely informed public. We will be very glad to give you any assistance on any further talks you may be giving.

Sincerely yours,

Leslie L. Motz
Metallurgical Chemist

LLM:ac

THE DEPARTMENT OF CHEMISTRY
UNIVERSITY OF OREGON
EUGENE

April 5, 1940

Mr. Leslie L. Motz
State Department of Geology and Mineral Industries
329 S. W. Oak Street
Portland, Oregon

My dear Mr. Motz:

I am truly up in the air or out on a limb, or something, in regard to this whole matter of cooperation in the black sand problem. In talking this over with Mr. Nixon I told him that we probably could manage to cooperate although at the time I was very conscious of the fact that without funds from outside of University sources the cooperation would have to be limited to the time which our faculty staff here, supplemented by such student help as we could get, would be able to give. Naturally these freely given facilities can be available only up until June first. At that time the students all leave and our faculty members have various summer engagements which can be broken only in case there is some emergency need for staying on the job in Eugene.

There were no understandings about possible contribution of funds to pay for such analytical work as we would not be able to handle in the way described above. Two weeks or more ago I began to be concerned about this whole uncertain situation and wrote Mr. Gleeson asking when I might go over to see him to talk over the whole project. This letter was written early during the Spring vacation with the expectation that I might be able to see him within a day or two. So far no reply has been received.

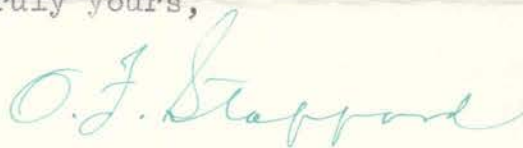
Failing in this effort to get into touch with Mr. Gleeson I rather stalled along hoping that I might get to Portland where I could see Mr. Nixon and have these matters clarified. However I have been very busy here and have had no occasion to go to Portland.

LLM-2

In your letter you say that Mr. Nixon has gone. What I should like for you to do is to let me know when he will return so that I can run down to Portland to see him. Meanwhile if you yourself are in position to give me any information regarding the probable amount of work to be done and the probable money aid, if any, which can be available for us to use here in hiring analytical help, then I believe we can at least go ahead tentatively.

I wish that I could give you definite information about the chances of women in the chemical industries but really I do not have enough information myself to tell you anything worth while. As you say, I have known of women in industrial laboratories and it is my belief that some of them get their jobs by direct appointment rather than through promotion from secretarial positions. For example, I was in a technical research laboratory in San Francisco two or three weeks ago where women were employed. What I suspect is this: that in plants such as the Du Ponts where there is a close relationship between laboratory work and plant operations the tendency would be to employ men only since men can be shifted from laboratory to plant or the other way around, whereas the plant as a rule is no place for a woman. On the other hand there are laboratories particularly in the food industries where women can do the work as well or perhaps even better than men. I wish very much that I was well enough informed so that what I might say would be helpful. Anyway I wish your sister the best of luck in getting a job in which she will be happy.

Very truly yours,



O. F. Stafford

OFS am

THE DEPARTMENT OF CHEMISTRY
UNIVERSITY OF OREGON
EUGENE

RECEIVED
JAN 31 1940

January 29, 1940

STATE OF OREGON GEOLOGY
& MINERAL INDS.

Mr. Earl K. Nixon
329 S.W. Oak Street
Portland, Oregon

My dear Mr. Nixon:

I am sorry indeed that delays have occurred in the chromite analysis which you want.

Possibly Mr. Staples has himself told you something of the difficulties which he encountered in getting the material from the sand. After several hours of work he delivered to us a product which I estimate may weigh as much as 1/10 of a gram. This he secured after making such magnetic separations as were possible and then simply pushing pieces about under the microscope in order to get what seemed to be true chromite grains.

I personally was not in physical condition to undertake the analysis of this material owing to a mild attack of flu which has kept me from engaging in full activities. The next best bet seemed to be to have one of our students, who really is fairly competent, acquire the techniques necessary for a chromite analysis. I may say that these techniques are not entirely easy to master. Several times down through the years I have undertaken to recover my skill at this particular stunt and always it takes a little while to get the feel of the analytical process so that one feels sure of results. For a new man starting in this really takes quite a while. The present problem is complicated by the fact that there is barely enough material to make one determination. Indeed the amount usually weighed out for a chromite determination is 1/2 gram instead of 1/10 gram of sample. With so small an amount to work with it seemed best to let the boy work with known materials until he quite confidently could check the figures of the analyzed sample. I believe that he is about ready to take a chance with the sample material which Dr. Staples gave us. As soon as that is done we shall be sending you the results.

7

EKN-2

Your letter relative to Mr. McMillan's work came in Saturday. I do not remember having heard of this work before and certainly I have no information at all relative to the process which he uses. From McMillan's letter to you it would seem that he is willing to do further work upon this process if he could have funds for the experimental work and some remuneration. If the amount involved is not too great it might be a good plan to see what he can do. We here have never undertaken any investigation of titanium. I have had some ideas which it seemed worth trying out relative to chromium only. However I should be glad to give the titanium matter some thought and if any hunches develop follow them through.

I shall be in Portland the coming weekend to attend a meeting Friday night. At the moment I am not sure whether we shall have to continue the meeting over into Saturday or not. In case there is time on Saturday and you are in your office I shall make it a point to look you up for a little visit.

Sincerely yours,



OFS am

O. F. Stafford

January 26, 1940

Dr. O. F. Stafford
Department of Chemistry
University of Oregon
Eugene, Oregon

Dear Doctor Stafford:

I can't recall whether I mentioned this to you or not, but I have thought a number of times, since you have taken an interest in the chemical angle of chrome, of the work done about three years ago by Professor F. A. McMillan now of the Department of Geology at the College of Puget Sound but formerly of the Department of Chemistry of that institution. I came in contact with McMillan over a period of a month or two during my manganese investigations on the Olympic Peninsula.

It seems that McMillan and two students of his were working on a process for the development of a flux for the reduction of the titanium content in black sands of the coastal area. They claim to have been quite successful and an agent of the Japanese government heard about it. They sent a metallurgist over from Tokio, and he spent some time with McMillan under an arrangement whereby a substantial remuneration would be paid. I wrote to McMillan the other day, and a copy of his reply, dated January 24th, is attached hereto.

Confidentially, I am not greatly impressed with McMillan's capacity as a geologist, and this would leave slight doubt as to his capacity as a chemist because I know his background.

Anyway, from my former conversations I received the distinct impression that he was effecting some unusual chemical reactions involving titanium and chromium in these sands by a combination of heat and pressure. He was using some kind of a steam chamber, although I note particularly in the present letter that he states that the process is not hydrothermal.

I have been under the impression for some time that none of us knows nearly as much as we should about chemical reactions at high temperatures and controlled pressure conditions. You appreciate that I would be apt to make a statement such as this about something of which I have practically no information. It is the human element. I am, nevertheless, wondering if there may not be something to this question of doing things with titanium and chromium under hydrothermal conditions. This is just a suggestion for anything it may be worth.

Sincerely yours,

EKN:vm
encl.

Director

January 26, 1940

Dr. O. F. Stafford
Department of Chemistry
University of Oregon
Eugene, Oregon

Dear Dr. Stafford:

Have heard nothing further from you in regard to the work you were doing on the chrome-iron ratio of the chromite grains of the sand, sample which was sent you some time ago.

We are anxious to take this matter up further with the U. S. Bureau of Mines if your results indicate that the material comes within the specifications cited by Mr. Jackson.

Cordially yours

Director

HEW:hk

January 2, 1940

Dr. O. F. Stafford
Department of Chemistry
University of Oregon
Eugene, Oregon

Dear Doctor Stafford:

Along the general line of another letter which is going to you in this mail but with another point in view I am sending you, under separate cover, a small average sample of bank-run, chrome-bearing black sand concentrate. This is partly at the suggestion of Dr. Smith.

I am anxious to learn as soon as possible something about the chrome-iron ratio in the chromite grains of the sample being sent you.

The reason for this is as follows: I am trying to sell the U. S. Bureau of Mines through my good friend, Charles F. Jackson, chief engineer, Mining Division, the idea of their assigning a strategic minerals project to the Coos Bay district, a project which would involve surface magnetic work and sampling. They are inclined to think favorably of the idea but are concerned about the chrome-iron ratio of the chromite product itself. You will recall that the government strategic minerals specifications call for a ratio of not greater than 1 part of Fe to 3 parts of Cr. It is my feeling that the chromite grains themselves are probably high grade in this back beach material.

Would it be possible for you to get Dr. Staples or someone with a petrograph microscope to segregate enough individual chromite grains from the sample being sent you to enable you to make a quantitative assay of the iron and chromium?

I am somewhat anxious for an early result on this matter because the complexion of this problem as an U. S. Bureau of Mines' strategic minerals project may determine in part whether I go East or not next month.

Sincerely yours,

EKN:vm

Director

cc: Dr. Warren D. Smith
Mr. George Gleeson

January 2, 1940

Dr. O. F. Stafford
Department of Chemistry
University of Oregon
Eugene, Oregon

Dear Doctor Stafford:

I had the pleasure of a short visit the other day with Dr. Smith at which time we had a chance to talk about various matters of mutual interest. During the conversation Dr. Smith stated that you had come to him for chrome data of various kinds and had indicated that you were of a mind to undertake some special studies, presumably of research type, in connection with chromium.

I believe I told you that we finally got something going on the idea I have had for several years, namely, that our beach or back beach sands may be of more value eventually as sources of chromite than for precious metals. About six weeks ago we took 500 pounds in 4 samples of black sand from the old Pioneer Mine, north of Bandon and found them to assay as follows:

Chromic oxide.	23.50%
Silica.	18.80%
Alumina.	27.22%
Iron Oxide as Ferric	18.00%
Titanium Dioxide	5.46%
Phosphorous.	0.52%

Composite samples have been sent to two eastern laboratories for magnetic and electrostatic tests. The results have not yet been received here.

Recently Mr. Motz was talking to George Gleeson at the College, and I understand that Mr. Gleeson also has in mind some work investigation on this same problem, although I have not yet had a chance to discuss details.

Dr. Smith and I came to the conclusion that we three agencies--Mr. Gleeson's department, your department, and this department--might get our heads together and see if we can work out an outline of study in which each of us can participate to a common end and without one duplicating the work of another. I understand Mr. Gleeson is considering the purchase of electrostatic equipment for metallurgical work and we are, of course, pleased to learn this.

January 2, 1940

It occurred to me that we might split up on some such basis as the following: let Mr. Gleeson handle the problem of mineral separation; you the study of examination, classification, and perhaps research chemical investigation of chrome metal deposition; and we would undertake to do the field work including geology, engineering, and certain cost angles. This suggestion is merely for consideration.

I think Mr. Libbey and I shall cruise southward the latter part of this week, Thursday or Friday, and I wonder if you, Mr. Gleeson, Dr. Smith, and I could not get our heads together and talk the situation over. Would you care to make a suggestion in this regard?

With best wishes for the New Year, I am

Sincerely yours,

EKH:vm

Earl K. Nixon, Director

cc: Dr. Warren D. Smith
Mr. George Gleeson

February 27, 1940

Mr. Donald B. Gillies, Vice-President
Republic Steel Corporation
Republic Building
Cleveland, Ohio

Dear Mr. Gillies:

I regret that you had not yet returned to Cleveland when I called at your office, February 21st. Mr. Smith was away also, but Mr. Ilgenfritz was kind enough to hear my story.

In brief, the situation as regards these chromite deposits is as follows: I am of the opinion that the tonnage of these deposits, running as follows:

Area 1 -- 12% Cr_2O_3
Area 2 -- 13% "
Area 3 -- 22-25% Cr_2O_3

is sufficient to justify serious consideration by any group in a position to utilize the higher grade product~~ion~~ which our testing indicates can be easily and cheaply made from the bank material mentioned above. The grade of the finished concentrate is substantially as follows:

Chromic oxide -- 40-45%
Titanium -- $\frac{1}{2}\%$ or less
Phos -- 0.20% or less
Iron -- 16-20%
Alumina -- about 3%
Silica -- about 3% or less.

The material is classified naturally about as follows:

7%, plus 30 mesh
85%, minus 30 mesh and plus 100 mesh
8%, minus 100 mesh

I am informed by Herbert Johnson, who developed the process of electrostatic separation bearing his name, that the cost of drying and separating the bank material on a production basis is of the order of 20-25¢ per ton. Johnson's machine is manufactured by the Ritter Manufacturing Company of Rochester,

February 27, 1940

and it was they who carried out tests and furnished the resulting samples which I showed to you in New York.

You indicated that you might wish to have bulk samples sent to a Minneapolis laboratory for testing. I suspect that you may wish further preliminary information on these deposits and, therefore, ask that you give this matter further consideration and tell us what you want in the way of data and details. If you prefer, I will get together results of testing we have done, assays, maps, and pictures of localities and present them for your consideration.

Thanking you, I am

Sincerely and cordially yours,

EKN:vm

Earl K. Nixon, Director



REPUBLIC STEEL CORPORATION

GENERAL OFFICES: REPUBLIC BUILDING

CLEVELAND, OHIO

RECEIVED
JAN 22 1940
STATE DEPT OF GEOLOGY
& MINERAL INDS.

DONALD B. GILLIES
VICE PRESIDENT

January 17th, 1940

Mr. E. K. Nixon
329 S. W. Oak Street
Portland, Oregon

Dear Mr. Nixon:

This acknowledges receipt of your letter of January 13th, and I am sending copy of same to Mr. Frank Blackwell. He has been slightly under the weather, which accounts for the delay in our furnishing you with the information I know you desire.

Very kind regards,

Yours very truly,

DBG:FIR

January 13 1940

Mr. Donald B. Gillies,
Vice Pres., Republic Steel Corporation,
Republic Building,
Cleveland, Ohio.

Dear Mr. Gillies:

I find your letters of January 4th and 6th on my desk on returning from a journey.

We have just received from another research laboratory products of electrostatic separation tests on a sample similar to the one sent to Mr. Blackwell. We have not yet had a chance to have any assaying done, but I may say that the high grade concentrate looks very good indeed. It appears to me that it will run at least 40% chromic oxide.

Evidently I neglected to send you the remaining analyses of the bank material. They are as follows:

Iron	18.00
Alumina	27.22
Titanium oxide	5.46
Phosphorus	.50
Silica	18.80

We noted that the high grade electrostatic product returned to us from this other laboratory contained perhaps 10% of non-metallics. Under the microscope this appears to be mainly quartz and garnets. I think there is no question but that jigs would remove practically all of the non-metallic minerals, so I am not concerned with the fact that the electrostatic concentrate is not absolutely clean.

Just now we are segregating enough of the individual chromite grains for assay so that we can determine the chrome-to-iron ratio of the chromite itself. I will advise you of this as soon as we have the information. With best wishes, I am,

Cordially yours,

Director

EKN:fas



R JAN 10 1940 D

STATE DEPT OF GEOLOGY
& MINERAL INDS.

REPUBLIC STEEL CORPORATION

GENERAL OFFICES: REPUBLIC BUILDING

CLEVELAND, OHIO

DONALD B. GILLIES
VICE PRESIDENT

January 6th, 1940

Mr. E. K. Nixon
329 S. W. Oak Street
Portland, Oregon

Dear Mr. Nixon:

Mr. Blackwell advises me of the receipt of the ore samples which you sent him. The analysis contained in your letter of December 29th do not show Chromium and a rather heavy proportion of Titanic Oxide.

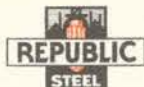
Due to the pressure of other work at this time of the year, we have not as yet given this sample attention. We will do so, however, at the earliest possible time and will forward you such results as we may develop.

Very truly yours,

DEB:FIR

cc-Mr. Frank Blackwell
Port Henry, New York

RECEIVED
JAN 8 1940



REPUBLIC STEEL CORPORATION

STATE DEPT OF GEOLOGY
& MINERAL INDS.

GENERAL OFFICES: REPUBLIC BUILDING

CLEVELAND, OHIO

DONALD B. GILLIES
VICE PRESIDENT

January 4th, 1940

Mr. Earl K. Nixon
329 S. W. Oak Street
Portland, Oregon

Dear Mr. Nixon:

Mr. Blackwell, our geologist at Port Henry, advises me he has received the sample of Chrome Sands from you. Thank you very much. Just as soon as he has completed his analysis of them, I will advise you further.

Very truly yours,

DBG:FIR

5

December 29, 1939

Mr. Frank Blackwell
c/o Republic Steel Corporation
Mineville, New York

Dear Mr. Blackwell:

I am very interested in learning whether or not you have had a chance to make any electrostatic tests on the black sand concentrate we sent you recently.

For your information, I have just received further analyses on this material, and they are as follows:

Silica - - - - -	18.80%
Alumina- - - - -	27.22
Iron Oxide as Ferric - - -	18.00
Titanium Dioxide - - - - -	5.46
Phosphorous- - - - -	0.52

The particular reason for my interest is that, if tests indicate any reasonable hope of success in treating the material in question, it might be desirable for me to go East in February to attend the A.I.M.E. meeting in New York and to go to Washington to try and complete a strategic mineral chrome project with the U. S. Bureau of Mines. Obviously I would have other reasons for going but, if the result of this chrome testing seems favorable, I would have added reasons.

Would you be good enough to advise me at your early convenience as to when we may expect some result from this work?

With kindest personal regards and wishing you a prosperous 1940,
I am

Sincerely yours,

EKN:vm

Director

December 1, 1939

Mr. Frank Blackwell
c/o Republic Steel Corporation
Mineville, New York

Dear Mr. Blackwell:

While President Gillies was in Portland in mid-October, I had an opportunity to discuss with him the possibility of concentrating some chrome-bearing black sand deposits of our Oregon back beaches. About a month ago I made a trip down the coast to the Coos Bay district and took four samples of about 125 pounds each of what appeared to be representative material. The four samples ran as follows in chromic oxide content, omitting decimals: 22%, 22%, 23%, and 25%.

Mr. Gillies in his letter of November 27th suggests that I send you a 25-pound sample for magnetic and electrostatic separation. This I am doing and I hope that you will be kind enough to report results at your reasonably early convenience. I have intended to have the work done by the U. S. Bureau of Mines with whom we have cooperative arrangements but have hesitated because, with the chrome work they are doing at the present time, it would be several months before we would get any results.

We are sending this material to you by parcel post.

With kindest personal regards, I am

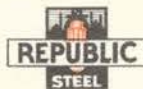
Cordially yours,

EKN:vm

Director

cc: Mr. Donald Gillies

RECEIVED
DEC 1 1939



REPUBLIC STEEL CORPORATION

GENERAL OFFICES: REPUBLIC BUILDING

CLEVELAND, OHIO

DONALD B. GILLIES
VICE PRESIDENT

November 27th, 1939

Mr. Earl K. Nixon, Director
State Department of Geology and Mineral Industries
329 W. Oak Street
Portland, Oregon

Dear Mr. Nixon:

Thank you very much for your letter of November 9th.

I would like to have our people do some magnetic and electrostatic work on the material you mention and if you will arrange to send 25 lb. samples to Mr. Frank Blackwell care of Republic Steel Corporation, Mineville, New York, I will appreciate it greatly.

I will be glad to communicate with you further when Mr. Blackwell has completed the work.

Very kind personal regards.

Yours very truly,

DBG:FIR

cc-Mr. Frank Blackwell

Black Sand

Dictated by John Eliot Allen--December 15, 1944

Sand
our black sand
spots
to

Magnetite Sand Plant for Ship Ballast. Operating Nevada Santa Cruz Company, 1999 Bryant Street, San Francisco.

Location: Four miles south of Aptos, Santa Cruz County on the beach and railroad, Monterey Bay. Located in the Capitola quadrangle.

Geology: For approximately two miles along the beach of Monterey Bay to the south and east of the plant location, lenses of naturally concentrated magnetite sand are deposited by winter storms along the bay over a 40 to 60 foot cliff. These lenses are from a few inches up to three or four feet in thickness and are from a few feet to several 10's of feet in width. The cliff behind the beach is composed of soft, unconcentrated deep red, cross bedded sand which has a high magnetite content and the black sand is undoubtedly derived from the erosion of these terrace deposits which are Pliocene or Pleistocene age.

Plant operation: During most of the year except for interruptions by winter storms this section of the beach may be traversed along the base of the cliff by large tired carry-alls with several yards capacity. The sand which in the natural state contains up to 30% magnetite is deposited over an automatic feed into which it is fed by a bulldozer at a rate of from 16 to 17 tons an hour. From the feeder it is lifted by a bulldozer directly to a 42" by 42" in two sections Pan American jig. The concentrate section of the jig feeds to a sand pump which delivers the concentrate to a classifier and stock pile. A belt conveyor

from beneath the stock pile loads the concentrate directly onto railroad cars at Manresa siding. The second half of the section delivers the lower grade material to two settling tanks from which it is fed to two 16 feet Wilfley tables. The concentrate of the first two Wilfley tables goes to the sand pump and classifier. The middlings from these two tables are delivered to a third table whose concentrates go to the sand pump. The tails from all three tables are delivered to a rock washer and are dumped on the beach.

The concentrate product must meet specifications requiring specific gravity of from 4.79 to 4.30. Pure magnetite of this type which contains some ilmenite has a specific gravity of about 5.05. The plant with a normal operation of some 8 to 10 hours a day can easily produce a car load a day of concentrate.

Added remarks relevant to the proposed access road from
The Lagoons

The Humphreys Gold Corp. plans to make a roughing concentrate containing 20% or more Cr_2O_3 , which will be hauled to the Defense Plant Corporation Separation Plant for final concentration and separation. There will be 62,500 L. tons of these roughing concentrates from the Humphreys Gold Corp. holdings at The Lagoons. In addition there is also another small section the The Lagoons, which is owned by the Pioneer Mine Co., and is as yet unexplored and probably contains from 10,000 to 20,000 L. tons of 5% plus Cr_2O_3 sand.

That portion of this proposed access road east of the Seven Devils Road is the logical outlet for possible concentrates from the Eagle and Pioneer mines area and the Shepard mine area. The following table shows the reserves of these two areas:

Table(Confidential - U.S.G.S.)

Deposit	Measurable		Indicated	
	L. tons	% Cr_2O_3	L. tons	% Cr_2O_3
Eagle and Pioneer mine area	246,000	8.8	145,000	7.5
Shepard mine area	128,000	6.2	33,200	8.6

The Eagle and Pioneer mines area is controlled by the Porter Bros. and the Shepard mine area is controlled by the Humphreys Gold Corp. Porter Bros. are still in the exploration stage. Humphreys Gold Corp. are planning to work the Shepard mine area.

It is further recommended that that portion of the Krome Corp. access road south and east of the junction with the proposed access road to the North Bank road, a distance of 4.5 miles, be made a two way road instead of a single road with turnouts, as it is now, because of much greater traffic than was first planned for.

The subsidy per ton was based upon 4.1 miles of road, at an estimated cost of \$5000.00 per mile for the Humphreys Gold Corp. holdings at The Lagoons.

cc: Mr. Lynch
Mr. Peoples

Signed _____
Allan B. Griggs
Assistant Geologist

December 15, 1942

ROUGH ESTIMATES OF CHROMITE RESERVES

	<u>Ore Grade</u>	<u>Concentrate Grade</u>	<u>Probable</u>	<u>Possible</u>
Southern Oregon				
Sourdough	47%	- - -	2,000	10,000
	10%	50%	10,000	20,000
Oregon Chromite	45%	- - -	2,000	5,000
Daley Creek	40%	50%	1,500	3,000
Briggs Creek	45%	- - -	1,000	2,000
	10%	- - -	10,000	20,000
Chollard	25%	45%	4,000	8,000
Shade	45%	- - -	500	1,000
			31,000	69,000

Northern California

Little Castle Creek	48%	- - -	10,000	20,000
	25%	50%	10,000	20,000
High Plateau	52%	- - -	5,000	20,000
Coggins	35%	50%	10,000	10,000
Hamburg	40%	- - -	1,000	5,000
	30%	48%	5,000	10,000
Cyclone Gap	45%	- - -	5,000	15,000
Doe Creek	40%	- - -	1,000	5,000
Hawkins	40%	- - -	1,000	10,000
Seiad Valley	45%	- - -	10,000	30,000
	25%	50%	30,000	50,000
Soldiers Wells	35%	?	500	2,000
Tyson	50% ?		1,000	5,000
Low Divide	50% ?		1,000	5,000
			100,500	207,000

131,500 276,000

*Chromite
tonnage estimate*

Black sand

CHROMIUM MINING AND SMELTING CORPORATION

Wholly-owned Subsidiaries
MONTANA FERROALLOYS, INC.
PACIFIC NORTHWEST ALLOYS, INC.
EXOTHERMIC ALLOYS SALES & SERVICE, INC.

N. A. TIMMINS, JR., PRESIDENT
R. A. TIMMINS, VICE PRESIDENT
H. B. MEGILL, EXEC. VICE PRESIDENT
AND GENERAL MANAGER

ADDRESS CORRESPONDENCE TO
13550 SOUTH INDIANA AVE.
CHICAGO 27, ILLINOIS
CABLE ADDRESS - CHROMASCO

October 22, 1956

State of Oregon
Department of Geology and Mineral
Industries
1069 State Office Building
Portland 1, Oregon

Attention: Mr. Ralph S. Mason,
Mining Engineer.

Dear Mr. Mason:

Please accept my apologies for the delay in replying to your letter of September 20, 1956 which was written with respect to our recent operations at Coquille, Oregon. The tardiness in my reply was due to the fact that I wanted to discuss your request with our Directors, as it involved passing on information which had only been obtained at quite an expense to ourselves.

I am verry sorry to advise that we cannot see our way clear to disclosing anything in connection with the Coquille operation. I do hope you will appreciate why this must be the case, for the time being, at least.

Sincerely yours,



H. B. Megill,
Executive Vice President and
General Manager.

HBM:af

PS 11

September 20, 1956

Mr. H. B. McGill
Chromium Mining and Smelting Corporation
13550 South Indiana Avenue
Chicago 27, Illinois

Dear Mr. McGill:

Mr. J. F. Hunt, who until recently has been associated with the Pacific Northwest Alloys black sand plant at Coquille, Oregon, has suggested that we write you. We originally asked Mr. Hunt if he could prepare an article on the operation of the Coquille plant, not knowing that he had moved to Florida where he is associated with Carpeo Manufacturing.

We feel that the Coquille plant achieved the first solid success in the beneficiation of the various fractions of the black sands occurring along the southern Oregon beaches and that a record of the process and a flow sheet of the plant would be of great interest to the mining and metallurgical professions. If possible we would like to have the information supplied in a form that could be reproduced in our monthly publication, The Ore.-Bin, or, if this is not feasible we would greatly appreciate receiving such information as is possible for our Departmental files.

There have been numerous attempts made over the past 75 years to up-grade the black sands and much money has been needlessly spent in ill-advised or fraudulent schemes. Some bona fide information on your successful operation would go far towards eliminating future undertakings which lacked adequate basic information.

Sincerely yours,

Ralph S. Mason
Mining Engineer

RSM:lk

MB

AFFILIATE OF
CARPCO RESEARCH AND ENGINEERING
CARPCO CONSTRUCTION CORPORATION
CARPCO EXPORT CORPORATION
CARPCO AUSTRALASIA, PTY. LTD.

Carpco
MANUFACTURING, INC.
JACKSONVILLE 6, FLORIDA
U.S.A.

ADDRESS MAIL TO P. O. Box 3272
PLANT LOCATION 4120 HAINES STREET
CABLE ADDRESS CARPCO
TELEPHONE EL 3-3681

September 14, 1956

Ref: M-439

Mr. Ralph S. Mason
Mining Engineer
State of Oregon
Department of Geology and
Mineral Industries
1069 State Office Building
Portland 1, Oregon

Dear Mr. Mason:

Your letter of September 7 was forwarded to me here in Jacksonville and, as you can see by this letterhead, I am now with Carpcoco. We manufacture various types of equipment and supply 100% engineering services for the mineral separation industry.

I regret that I must turn you down on your request that I prepare an article outlining the metallurgical and economical problems involved in our processing of the government chrome stockpile at Coquille. Permission to do this would, of course, have to be obtained from Mr. H. B. Megill of Chromium Mining and Smelting Corporation, 13550 South Indiana Avenue, Chicago 27, Illinois, of which company Pacific Northwest Alloys, Inc. in Spokane is a subsidiary.

To my knowledge, George Murphy is still in Coquille and would be in a good position to prepare such an article for you. I suggest, if you so desire, that you make this request of Mr. Murphy at Box 825, Coquille, Oregon. He, in turn, can get the necessary permission from Mr. Megill and work with you on this subject.

Very truly yours,
CARPCO MANUFACTURING, INC.


J. F. Hunt
Assistant to the President

JFH/k1

September 7, 1956

Mr. J. F. Hunt
Pacific Northwest Alloys, Inc.
2032 Shelley Road
Coquille, Oregon

Dear Mr. Hunt:

We are sorry to learn that you are currently dismantling the Coquille plant. This operation presented the first valid attempt to beneficiate Oregon's black sands and we are anxious to obtain, if at all possible, as many details of the operation as possible. Would it be possible for you to prepare an article for our monthly publication, The Ore.-Bin, in which you would outline the metallurgical and economic problems involved in your process? We feel that such an article would be of tremendous interest, not only to professional metallurgists and mining men but to many others who from time to time venture into operations of this type without adequate information.

We appreciate, however, that there may be reasons for not wishing to divulge this information at the present time, in which case we would like to obtain it for our Departmental files. If you find it possible to prepare an article for The Ore.-Bin we will be happy to render you every assistance possible in the matter of preparation of diagrams and illustrations or any other material which could be used in connection with the article.

Sincerely yours,

Ralph S. Mason
Mining Engineer

RSM:lk

Black sand

August 11, 1952

Mr. Judson S. Hubbard
The Humphreys Investment Company
First National Bank Building
Denver 2, Colorado

Dear Mr. Hubbard:

Receipt is acknowledged of your letter dated August 6, inquiring about the Coast Minerals Company, Ltd., mentioned in an item in our April 1952 Ore.-Bin.

We have no further information on operations in the Bandon-Whiskey Run area of Coos County. Because of field work we are engaged in, and our small personnel we have been unable to visit reported activity along the coast. We hope to do this in the near future, and if we find out anything of importance I will let you know.

Very truly yours,

F. W. Libbey
Director

FWL:lk

P.S. - I have just been informed that Coast Minerals Company is operated by Mr. George Murphy, whose address is probably Bandon, Oregon. Mr. Murphy is engaged in some dredging enterprise in Idaho aside from his work here in Oregon.

I. B. HUMPHREYS, PRESIDENT
A. E. HUMPHREYS, VICE-PRESIDENT

JUDSON S. HUBBARD
VICE-PRESIDENT AND TREASURER

THE HUMPHREYS INVESTMENT COMPANY
FIRST NATIONAL BANK BUILDING
DENVER 2, COLORADO

CABLE ADDRESS
"HUMPHREYS"

August 6, 1952

ADDRESS REPLY TO
ENGINEERING DIVISION

OUR REF. G-9271-ED

YOUR REF.

Director
Oregon State Department of
Geology and Mineral Industries
329 Southwest Oak Street
Portland, Oregon

Dear Sir:

MINING CONGRESS JOURNAL refers us to you upon our request for the address of Coast Minerals Co., Ltd., which was mentioned in a news item which they lifted from your publication, "The Ore-Bin, Vol. 14, No. 4, page 26".

This was a report of commencement of stripping operations on the black sand deposit, Coos County, Oregon on Whiskey Run Beach. We wish to communicate with the company in this connection.

Thanking you for what help you can give us, we are

Yours very truly,

jsh/g

Judson S. Hubbard

RECEIVED
AUG 8 1952
STATE DEPT. OF GEOLOGY
& MINERAL INDS.

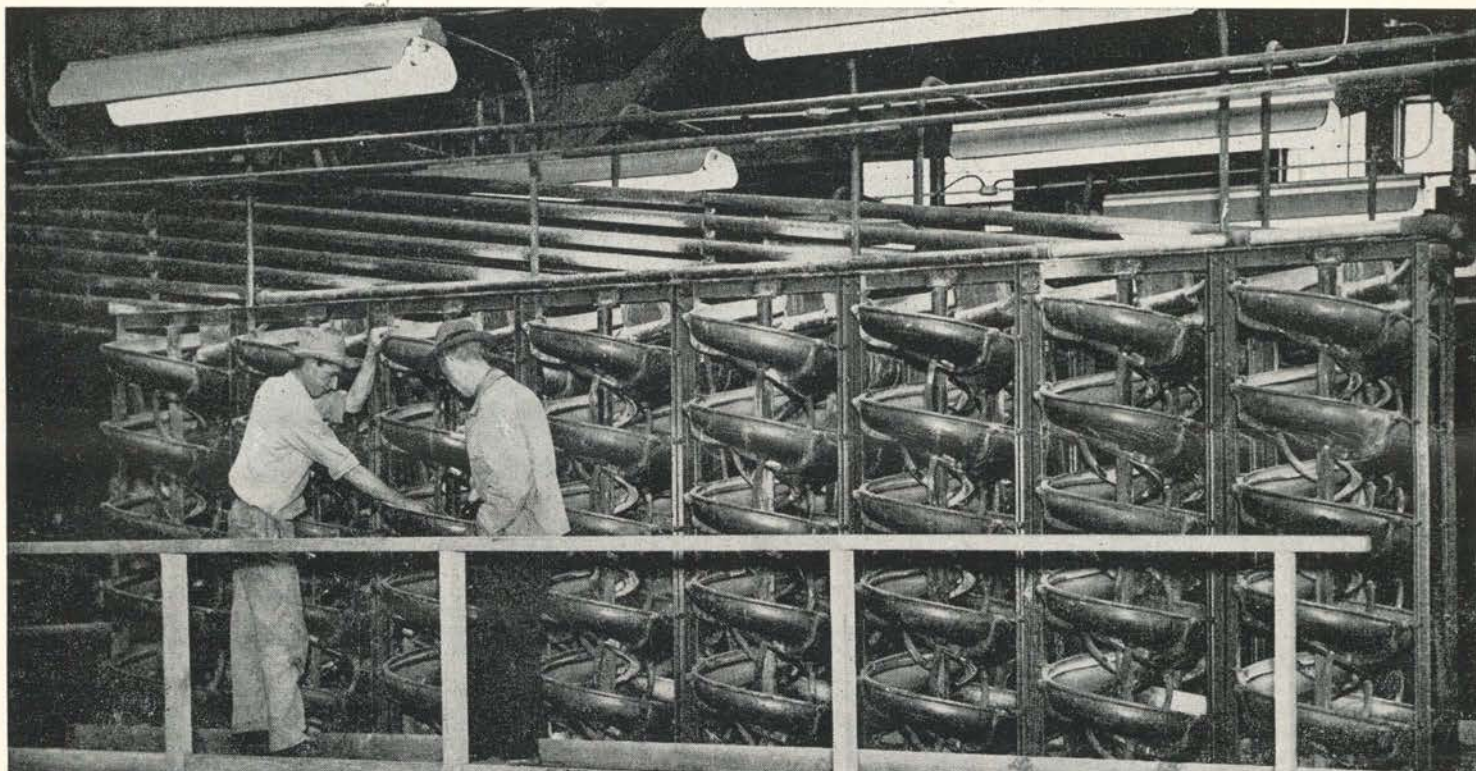
for

BULLETIN NO. 8—Reprinted from MINING WORLD, September, 1948

THE HUMPHREYS INVESTMENT CO., ENGINEERING DIVISION

FIRST NATIONAL BANK BUILDING

DENVER, COLORADO



Above view is in the Climax Molybdenum plant where 128 spirals handle 6,000 tons per day of flotation mill tailings for recovery of tungsten product. The men are F. J. Windolph, shift boss, and E. J. Duggan, mill superintendent.

SPIRAL CONCENTRATION

Plant operating data on a variety of materials with a wide difference of specific gravity, ranging from anthracite and phosphates to lead-zinc

Early use of the Humphreys Spiral Concentrator, invented by I. B. Humphreys of Denver, Colorado, was reported by Mining World in October, 1943, which described the production of chrome concentrate from ancient beach sand deposits in Coos County, Oregon.

The outstanding feature of the spiral is the simplicity of operation and low cost of concentration of minerals. Ground ore, fine coal, sand or other material to be concentrated or cleaned is delivered with water to the top of the spiral. As the pulp flows down the spiral channel of modified semi-circular cross-section, the heavier particles move in toward the inside of the channel on a band of heavy mineral concentrate, while the lighter particles travel farther out in the channel with the faster running water. Concentrate is drawn off from concentrate ports located at 120° intervals near the inside edge of the channel.

There are no moving parts; floor space per ton treated is very small;

By Judson S. Hubbard *

and installation, maintenance and operating costs are so low that spirals have effected economical concentration of materials which could not heretofore be worked at a profit.

Size range of material suited to spiral separation depends to some extent on the specific gravity of the minerals present, the grind necessary for their liberation, and the shape of the particles. On suitable material good concentration is generally made on pulp containing heavy mineral particles between 14 and 200 mesh, with a decreasing recovery below 200 mesh. However, fine coal up to $\frac{1}{4}$ ", provided the refuse particles are not over 14 mesh, may be cleaned in spirals.

*Vice-president and treasurer, The Humphreys Investment Company and Humphreys Gold Corporation, Denver, Colorado.

Since their introduction in 1943 spirals have been proved by large-scale plant operations in treatment of a variety of minerals. Examples are described as follows:

Chromite

At the chrome concentrating plant of Humphreys Gold Corporation in Coos County, Oregon, 30 spirals treated 1,000 tons per day of fine chrome bearing sands averaging 12% Cr_2O_3 , which was concentrated in the spirals to a product containing about 25% Cr_2O_3 and all of the other heavy minerals including magnetite, ilmenite, garnet, zircon, olivine, and several others. This spiral concentrate was shipped by truck to a Defense Plant Corporation concentrator where it was raised by magnetic separation and flotation to a grade of about 40% Cr_2O_3 . The spiral plant operated very successfully from March to December, 1943, and was then shut down upon cancellation of the contract because of the opening of the Mediterranean to shipping and consequent accumulation

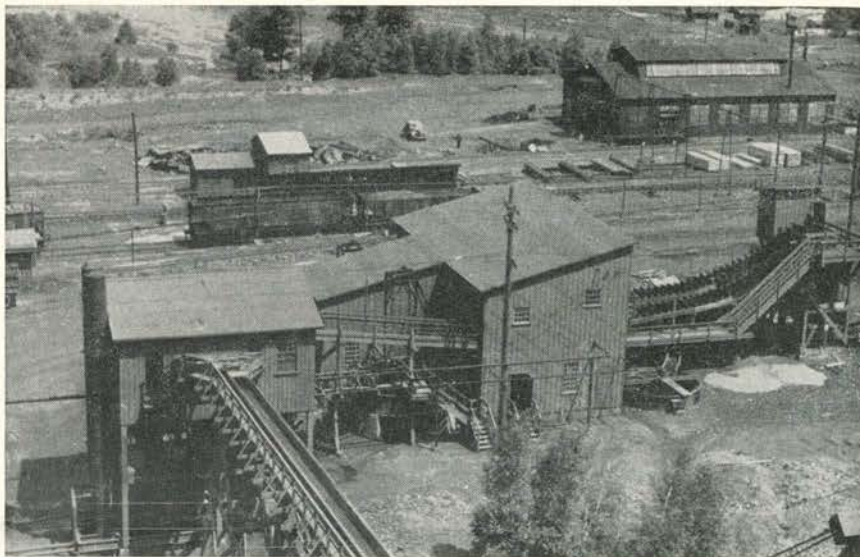
by Metals Reserve Company of ample stock-piles of chemical chrome from abroad.

Early in 1943 Krome Corporation also built a plant for production of chrome bearing heavy minerals for shipment to the same D.P.C. plant, equipping it with shaking tables, but the tables proved uneconomical in this use and in the fall of 1943, 56 spirals were installed and operated successfully until December when the Krome Corporation plant was also shut down. The 56 spirals at Krome Corporation were later purchased by Pacific Bridge Company and installed in its base metal tailing treatment plant at Park City, Utah, which is described later in this article.

Ilmenite, Rutile and Zircon

In the spring of 1944, Humphreys Gold Corporation's excavating equipment and spiral plant were shipped from Oregon to the operation of the Titanium Alloy Manufacturing Company (Rutile Mining Company of Florida), located about seven miles east of Jacksonville, Florida. This company was producing rutile and ilmenite, both "critical minerals," and it was necessary to increase production. Excavation had been by dragline from fixed mast; concentration was by tables and flotation; the concentrate, containing numerous heavy minerals and some silica, was sent to a dry plant for separation of rutile and ilmenite by electromagnetic and electrostatic separators. Under contract with these companies, Humphreys Gold Corporation substituted its crawler mounted dragline equipment for excavation, installed its crawler mounted screening plant and substituted spirals for the tables and flotation equipment. One hundred ninety-two spirals of an improved 24" diameter model were manufactured in Denver and shipped to Florida. Production was tripled. Subsequent sampling of the deposit showed values below water level, to which depth dragline excavation was limited, and in the summer of 1945 a suction dredge with 15½" Amsco-Nagle pump was installed. Production was increased, additional spirals were installed and capacity of the dry mill increased.

After cessation of hostilities the price of ilmenite decreased considerably, principally because of decrease in ocean freight and insurance rates from Travancore, India, the principal world source of ilmenite. The price of rutile also decreased. There was, however, a substantial demand for zircon and in the summer of 1946 Humphreys Gold Corporation built an additional mill with rotary drier and electromagnetic and electrostatic separating equipment for production of zircon from the ilmenite-rutile dry mill tailing. Production of these three products ilmenite, rutile, and zircon, has continued. Some 9,000,000 tons of sand have been mined and concentrated since Humphreys Gold Corporation commenced operation in April, 1944. No replacement of a spiral concentrator has been made except that



The Hudson Coal Company plant using 48 spirals for cleaning anthracite silt from current production and retreating 1,500,000 ton silt bank accumulated during the past 50 years at their Powderly Colliery.

the 30 spirals of 30" diameter originally moved from Oregon were replaced by a larger number of 24" diameter spirals to increase production from the same floor space.

Approximately 7,500 tons of sand per day is now being mined and delivered to 252 rougher spirals, 54 second stage spirals and 18 third stage spirals, the concentrate going to the dry mill for production of rutile and ilmenite. Tailing from this dry mill then goes to 60 spirals in four stages and the spiral concentrate to the other dry mill for production of zircon. The

three products total approximately 4,000 tons per month.

Iron Ore Fines

Early in 1947 Butler Brothers, producers of iron ore on the Mesabi Range, following tests made with a single spiral the preceding year, installed a spiral pilot plant at their Patrick Washer near Cooley, Minnesota, for continuous tests on classifier overflow of wash ore at about 20 long tons per hour. Results were encouraging and pilot plant operation is continuing during the 1948 season.

Detail drawing illustrates concentrating action of the spiral. Note wide black band of heavier concentrate entering upper outlet, which is set for a thick cut; also the narrower black band of middling entering lower outlet which has been set for thin cut.



TABLE NO. 1

Typical Results in Two-Stage Spiral Concentration of Minus 1/8-Inch Mesabi Iron Ore

	Feed to Primary Spirals			Concentrate from Secondary Spirals			Tailing from Primary Spirals		
	% Wt.	% Fe	% SiO ₂	% Wt.	% Fe	% SiO ₂	% Wt.	% Fe	% SiO ₂
-3+6	95	60.20	9.20	74	62.80	6.30	18		
-6+8	3.68	58.30	12.10	2.87	62.90	5.80	5.00	48.40	25.50
-8+14	12.46	57.90	13.30	9.96	63.60	5.50	17.02	44.70	31.70
-14+28	21.90	52.10	21.40	18.85	59.00	12.30	22.30	44.50	44.50
-28+35	15.00	49.20	25.80	17.05	53.00	20.20	7.86	27.00	58.50
-35+48	15.03	50.10	25.05	18.14	52.20	21.80	3.98	21.10	67.40
-48+65	8.30	50.80	23.80	13.05	53.60	20.50	2.34	19.80	69.30
-65+100	8.10	51.50	23.25	10.02	55.10	18.30	2.96	22.30	65.90
-100+150	4.25	50.20	24.95	4.83	56.40	16.70	3.22	25.10	61.90
-150+200	3.56	44.80	33.10	2.82	56.40	16.90	4.96	24.10	63.20
-200	6.77	30.60	53.70	1.67	48.50	28.40	30.18	28.80	56.30
Total	100.00	50.44	24.24	100.00	55.87	16.74	100.00	33.01	49.61
Recovery—76.25% weight; 84.45% Fe.									

Cleveland-Cliffs Iron Company, during the winter of 1947-48, installed 48 first stage and 36 second stage spirals at its Hill-Trumbull mine to treat its minus 1/8" screen undersize iron ore at the rate of about 100 long tons per hour. Flow sheet is shown in Fig. 1. The plant is producing the desired grade of concentrate with good recovery. The minus 1/8" slotted screen undersize from the heavy density plant is given an abrasion grind in a ball mill to release sugary silica attached to iron oxide particles. This light grind gives a spiral feed of about 97% minus 8 mesh.

Table No. 1 shows typical results of two stage spiral concentration of Mesabi iron ore fines.

Cleveland-Cliffs Iron Company has also installed a pilot plant at its Holman-Cliffs mine, using 8 first stage, 4 second stage and 2 third stage spirals, for test work on their classifier overflow of wash ore.

A pilot plant of substantial size is also being operated by Jones & Laughlin Steel Corporation on iron ore fines at Benson Mines, Star Lake, New York.

Mo Flotation Mill Tailing

After preliminary tests in a Humphreys Spiral Concentrator closed circuit test unit and continuous tests in a pilot plant using four spirals and nearly all of the accessory equipment of a full size plant, Climax Molybdenum Company, Climax, Colorado, installed equipment in the early summer of 1948 for recovery of tungsten concentrate from its molybdenum flotation mill tailings. Approximately 8,000 tons of minus 48 mesh tailings are being treated daily. Part of the tonnage is overflowed by Akins spiral classifiers and pumped to waste and the underflow, containing approximately plus 150 mesh light minerals and plus 325 mesh heavy minerals, is pumped as feed to 128 Humphreys Spiral Concentrators, the concentration ratio being about 40 to 1. The concentrate goes to flotation cells for removal of pyrite and then to six Wilfley tables for elimination of a

portion of the remaining heavy minerals. Table concentrate goes to wet Crockett type magnetic separation for removal of iron from the ball milling and then to dry Wetherill type magnetic separation to produce tungsten concentrate which is bagged for shipment. One man per shift operates the plant with the exception of occasional help in the bagging of the product. Table No. 2 from pilot plant tests gives results of spiral separation without desliming prior to spiral concentration. Current plant operating results are similar except that the fine sizes are eliminated by desliming prior to spiral concentration.

It should be noted that the low recovery in plus 100 mesh sizes is due to insufficient liberation of minerals at the minus 48 mesh grind.

Comparison of floor space used by spirals and tables in this plant is of interest. The 128 spirals, treating about 6,000 tons per day, require only 35' by 50', a total of 1,750 sq. ft., or 0.29 sq. ft. per ton per day. The six tables treating about 125 tons per day use 24' by 56', a total of 1,344 sq. ft. or 10.75 sq. ft. per ton per day. Spirals are mounted on a light timber struc-

ture while the tables have the usual concrete foundation.

Lead Carbonate and Sulphide Dump Ores

John Hamm Mining & Milling, Ltd., for more than a year has operated a plant using 18 spirals for concentration of ore dump material at Leadville, Colorado. The flow sheet is varied from time to time depending upon the character of the material. The ore is crushed and ground and sometimes a spiral concentrate can be produced for delivery direct to smelter. On other material spirals are used to eliminate a tailing, the rougher concentrate going to flotation. On still other material, the ball mill product goes to flotation and the flotation tailing is then spiraled.

Lead-Zinc Mill Tailing

In 1946 Pacific Bridge Company built a plant at Park City, Utah, for treatment of the old Grasselli mill tailing, installing 56 spirals. The tailing material was mined and conveyed to the plant by bulldozers and carryalls and pumped to the spirals, which discarded final tailing. Spiral concentrate was reground and delivered to flotation cells. The discharge from the bottom of the spirals was deslimed in a hydroseparator; the sand portion was pumped out of the plant as a final tailing, and the slime, after thickening, was delivered to flotation cells. The flotation section produced a lead concentrate and a zinc concentrate.

The Grasselli tailing deposit for which the mill was built was exhausted early in 1948. Plant operation with a fair amortization charge, was profitable during the treatment of this tailing material. The spiral plant concentrating results exceeded the results of the spiral test work upon which the plant was designed and built. The mill is continuing operation on material from other deposits which is being

TABLE NO. 2

Typical Humphreys Spiral Concentrator Results Climax Molybdenum Company Flotation Tailing Pond

Mesh or micron size	SPIRAL FEED			SPIRAL TAILING			SPIRAL CONCENTRATE		
	% Wt.	% WO ₃	Distribution	% Wt.	% WO ₃	Distribution	% Wt.	% WO ₃	Distribution
+100	40.1	.007	7.9	40.0	.006	10.5	26.0	.135	8.1
-100+200	21.2	.034	20.4	20.7	.005	4.4	42.7	.430	42.2
-200+325	7.1	.061	12.2	6.8	.011	3.5	10.4	.850	20.2
-325+30 microns	9.9	.106	29.6	10.4	.080	36.4	10.8	1.13	28.1
-30+10 microns	9.7	.035	9.6	12.0	.035	18.4	5.9	.065	0.9
-10	12.0	.060	20.3	10.1	.060	26.8	4.2	.057	0.5
	100.0	100.0		100.0	100.0		100.0	100.0	

Recovery Figures for Various Size Fractions

Size fraction	Recovery figured from head and tail assays	Recovery figured from concentrate and tailing metal balance
All sizes combined	35.5	32.0
+100 Fraction	14.3	25.0
-200+325 Fraction	85.3	80.0
-200+325 Fraction	82.0	72.5
-325+30 micron fraction	24.5	26.4
-30+10 micron fraction	NH	2.8
-10 micron fraction	NH	1.7

hauled in by truck. This material, requiring fine grinding for liberation of minerals, is better suited to all flotation treatment, and the spirals are being held in standby condition.

Phosphate Fines

In 1946 International Minerals & Chemical Corporation installed spirals to carry out preliminary runs on separation of fine phosphate rock from sand at one of its Florida plants which had for some time been treating the material on shaking tables. Following these runs the company installed 46 spirals at its Achan plant, later increasing the installation by the addition of 108, making a total of 154 spirals at the Achan plant. These spirals treat approximately two tons per hour per spiral of -1 mm. $+200$ mesh feed averaging 25% to 40% BPL to make a concentrate of about 72% BPL and a tailing of 8% BPL or less.

Since specific gravity of the phosphate rock and of the sand to be separated is approximately the same, it is necessary to first treat with reagents as has been the practice for some time in table agglomeration. Reagents used are caustic soda, fatty acids, and fuel oil.

International Minerals & Chemical Corporation also installed in its Noralyn plant, which commenced operation in April, 1948, 88 spirals to treat approximately -1 mm. $+48$ mesh phosphate matrix, the -48 mesh material going to the flotation section of the plant.

Anthracite Silt

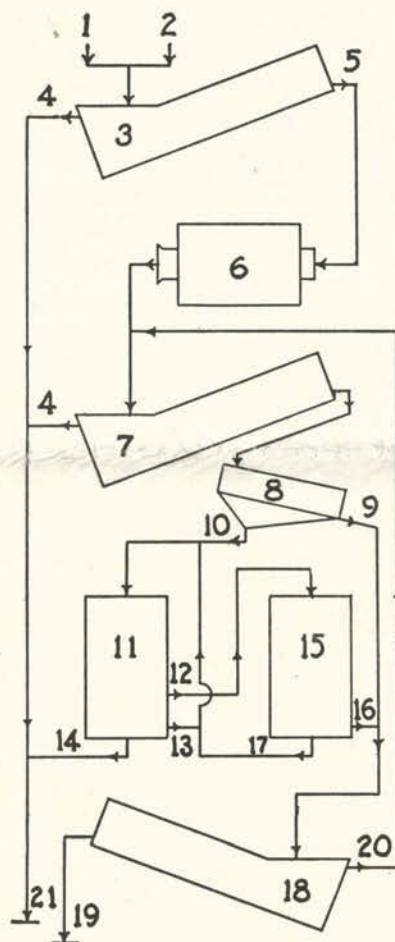
The Hudson Coal Company, after tests in the closed circuit test unit in Denver, installed a pilot plant at its Powderly Colliery near Carbondale, Pennsylvania, for recovery of fine coal from anthracite silt from a silt bank and also from current breaker wastes taken from the underflow of a Dorr thickener.

Based on the pilot plant studies, the company installed 48 Model 24-C, 6-turn spirals, which commenced operation in the spring of 1947. Up to the end of September, 1947, the spiral plant had prepared approximately 30,314 tons of about 16% ash fuel for colliery power plant use. The minus $3/16$ " anthracite silt spiral plant feed (underflow from a Dorr thickener handling breaker waste water) varying from 30-36% ash, was approximately 500 tons and coal recovery approximately 300 tons per seven-hour shift.

During the winter a large Sauerman scraper unit was installed to recover the bank material. During June, 1948, an average of 660 tons of 16.5% ash fuel was produced per 14-hour day. One seven-hour shift used bank material alone for the feed and the other shift used mainly Dorr thickener underflow, plus sufficient bank material to load the plant.

The Hudson Coal Company is build-

FLOW SHEET CLEVELAND-CLIFFS IRON COMPANY



LEGEND—FIG. NO. 1

1. Minus $1/4$ " product from screens. 2. Product from log-washers. 3. Four 66" Akins classifiers. 4. Classifier overflow to plant tailings. 5. Minus $1/4$ " classifier underflow. 6. One 6' x 10' Allis-Chalmers ball mill. 7. One 78" Akins classifier. 8. One 6' x 8' Allis-Chalmers low-head $1/8$ " slotted screen. 9. Plus $1/8$ " screen oversize. 10. Finished product to dewatering classifier. 11. Minus $1/8$ " screen undersize to primary stage spirals. 12. Forty-eight primary stage 5-turn Humphreys Spiral Concentrators. 13. Primary spiral concentrate to secondary stage spirals. 14. Primary spiral middling returned to primary spiral feed. 15. Primary spiral tailing to plant tailings. 16. Thirty-six secondary stage 3-turn Humphreys Spiral Concentrators. 17. Secondary spiral concentrate. 18. Finished product to dewatering classifier. 19. Secondary spiral tailing returned to primary spiral feed. 20. One 60" Akins classifier for dewatering concentrate. 21. Finished dewatered concentrate to railroad cars. 22. Dewatering classifier overflow returned to 78" Akins classifier feed. 23. Plant tailings.

ing, during this fall and winter, a second spiral cleaning plant at another colliery, which will use 40 spirals, to produce commercial power plant fuel with a 14% ash content.

1,100-Ton-per-Hour Titanium Plant

Humphreys Gold Corporation is building and will operate a plant for recovery of titanium minerals and zircon at the Trail Ridge, Florida, de-

posit described in MINING WORLD June, 1948. The plant is designed to treat about 1,100 tons of sand per hour delivered by suction dredge with 20" Amsco-Nagle pump. For economy of power required in pumping material the spirals will be mounted on barges floating in the dredge pond, one barge 158' x 63' supporting 704 first stage spirals with pumps, another barge 90' x 43' supporting 200 second stage and 100 third stage spirals with pumps. First stage spiral tailing will be discharged into the dredge pond as waste and third stage spiral concentrate will be pumped to a plant on land for dry electromagnetic and electrostatic separation. The spiral barges will move along with the dredge as mining progresses.

Ore Concentration Tests

For investigation of suitability of various ores to spiral concentration, closed circuit test units, using a full size spiral, have been purchased by seven of the regional testing or research laboratories of the Metallurgical Division of the United States Bureau of Mines. Ten American colleges and universities and ten similar institutions in other countries have purchased closed circuit test units. Full size spirals for test and pilot plant work have also been shipped to mining operators in twenty-six other countries for work on precious and base metal ores and on ores of iron, tin, titanium, chrome, potash, tungsten, barytes and on coal.

Tests of various ores suitable to spiral concentration may be made at many of the Bureau of Mines laboratories or at the spiral testing laboratory maintained by the Engineering Division of The Humphreys Investment Company, Denver, Colorado.

Economy

Since the first plant installation in 1943 on Oregon chrome beach sands, use of the spiral in plant operation has steadily broadened into new fields of concentration of minerals suited by difference in specific gravity and size range to this method of concentration.

This growth is recognition of certain outstanding features of spiral concentration. These are principally the low first cost, installation cost, maintenance cost and operating cost. There are no moving parts, no vibration, weight per unit of capacity is low, and, consequently, only light foundations are required. Maintenance costs are principally replacement of pumps and distribution piping. Operation is nearly automatic, so that cost of operating labor is extremely low, and the operator can quickly learn adjustments necessary for good results. The spirals are readily portable, and have been shipped to inaccessible mines in packages of 50 kilograms by muleback. Another very important factor is the extremely small floor space required for a spiral plant of large capacity. These features together result in marked economy.

TESTIMONY BEFORE SENATE MILITARY AFFAIRS SUB-COMMITTEE
 Washington, D. C. -- May 26, 1941.

Order of Testimony:

1. Introduction -- (over 10 yrs. chrome
 (Developments -- patents
 (Outlook of one engaged in developing processes
2. Present methods of using chromite ore (if wanted)
3. Domestic Resources in West.
4. Need of utilizing low-grade reserves
 - (1) Use by present methods -- ECONOMICS -- make 70% Cr. now
 could we use 50% Cr.?
 - (2) Use by new methods
5. Development of process at O.S.C.
- (6. Futile attempt to interest government agencies.)
 (early in 1940)
 (
- (7. Then further development through industry.
 can't wait till emergency to develop new methods -- takes time--time
 can't be bought even by Government. (will be slow)
 --Industry can use Cr. in place of FeCr or could make FeCr from
 Cr + Fe by melting only minor matter.
8. Failure of stock-pile program.
 - (A) Due to failure to set proper specifications and prices
 - What is practical spec. now is not in abnormal times.
 - Stock unbeneficiated ores.
 - Stockpile figures on Chromite.--Who set specifications?
 People interested in getting stocks
 or not?
 (Should stock materials to be used in abnormal times, etc.)
 - (B) Should determine lowest grades that could be used by known methods
 in area of need. (27% used in last war by chemical people--could
 make CrO₃ then Cr.
 - (C) Foreign ores, all kinds from Asia, should be stocked in West Coast.
 (near cheap power)
 Boats should all unload on nearest coast--more trips while they can
 still travel unconvoyed, etc.
 - (D) Can't buy domestic ores by contracting in Washington, D. C. -- small
 operators can't come back here -- should buy in territory at adjusted
 prices.
9. Domestic Mineral Development Program.
 - Prospectors must be encouraged, etc.
 - (A) Should be done in collaboration with State Geol. & Min. depts.
 --Process development
 - (B) Bureau of Mines should not try to do all the work--with small sums
 set aside for cooperation with capable schools much more could be
 accomplished -- many more scientists put to work on a problem --
 different outlooks than that of mining specialists.

File Chrom

10. A word on this last as applies to my own state.

-- see G.W.G. #1 - #4 - #3 -

11. The big fields opening through low cost power.

(A) Means entirely new processes capable of development because such enormous amounts of energy economically available -- those processes should be encouraged.

CHROMITE
(as Chromite — 50% Cr₂O₃)

Tons Estimated	Location	By	Ref.
10,000 ^o	Piliken	U.S.G.S.	922-0
500,000* to possible 2,000,000 *ctns. TiO ₂	Coos back beaches	E. Nixon	
60,000 1,800 4,869 2,000 + 500,000	Seiad Crk. Farrow Crk. McGuf " Others J. Day	U.S.G.S. " " " " " & others	922-J " " " "
540,000 ^{xo} (20-50%)	Piliken	U.S.G.S.	922-0
200,000	Seiad Crk .	U.S.G.S.	922-J
50,000-100,000 suggested	Sourdough ore	U.S.G.S.	922-P
6,000-9,000	Briggs	U.S.G.S.	922-P
4,120,000 ^o	Piliken	U.S.G.S.	922-0
24,000,000-37,700,000 ^o + 200,000 Millions	Piliken Seiad Crk. Present beaches, Coos & Curry	U.S.G.S. " J.S.	922-0 922-J
50,000,000-100,000,000 ^o	Piliken	U.S.G.S.	922-0
Unlimited	Pres. beaches Oregon	J.S.	

Note: ^o 30-50% Cr₂O₃ in Piliken ore, much known to contain 45%.

OREGON STATE COLLEGE
SCHOOL OF ENGINEERING AND INDUSTRIAL ARTS
CORVALLIS, OREGON

DEPARTMENT OF
CHEMICAL ENGINEERING

November 4, 1941

FILE

RECEIVED
NOV 5 1941

STATE DEPT OF GEOLOGY
& MINERAL INDS.

Mr. F. W. Libbey,
Mining Engineer
State Department of Geology and Mineral Industries
702 Woodlark Building
Portland, Oregon

Dear Mr. Libbey:

Enclosed are the remaining determinations of density and the corresponding chromite percentage for the various hole samples in the Marshfield drilling program. I believe the submission of this information completes the request which you have made up to date and insofar as we are concerned completes our part of the cooperative program. I anticipate saving about four pounds of each sample, if such is available, and filing the same away for future reference.

Very truly yours,

G. W. Gleeson

George W. Gleeson,
Professor of
Chemical Engineering

GWG:jn

RESULTS OF SPECIFIC GRAVITY MEASUREMENTS OF DRILL
HOLE SAMPLES FROM MARSHFIELD DRILLING PROGRAM

<u>Hole No.</u>	<u>Sample No.</u>	<u>Density</u> <u>Lb./Cu. Ft.</u>	<u>Percent by Weight</u> <u>Cr₂O₃</u>
27A	17	147.3	15.76
27A	18	128.8	8.67
27A	20	119.4	6.31
27A	21	110.8	3.18
32	8	100.0	0.00
32	7	106.1	1.05
32	6	122.4	4.24
26A	14	108.5	4.04
26A	13	110.5	7.26
26A	12	111.0	7.73
26A	11	110.9	7.27
26A	10	108.7	5.64
18S	1	98.4	0.69
18S	2	95.3	0.00
30A	1	119.7	12.5
30A	2	137.1	11.9
TP33	1	124.1	15.1
RML	3	144.7	26.9
24	3	107.2	2.30
24A	5	111.8	3.97
24A	6	119.6	5.86
24A	7	100.5	3.00
TP31	1	139.6	19.3
Shep. M. Tailings		119.3	8.89
TP 25	1	98.4	3.89
19	10	132.5	9.78
19	11	137.0	11.7
19	12	130.0	6.33
19	13	122.3	3.86
19	14	125.2	6.45
21A	5	83.1	0.00
21A	6	82.2	0.00
21A	7	85.7	1.32
21A	8	110.5	0.47
21A	9	107.8	0.00
21A	10	104.6	0.00
21A	11	113.4	0.00
21A	12	118.3	0.00
21A	13	114.1	0.00
21A	14	112.9	0.99
19	9	126.3	11.9
19	8	113.9	6.23
19	7	109.0	4.90
29	1	109.1	2.04

<u>Hole No.</u>	<u>Sample No.</u>	<u>Density Lb./Cu. Ft.</u>	<u>Percent by Weight Cr2O3</u>
29	2	111.7	1.46
29	3	107.4	0.76
29	4	109.3	0.00
29	5	101.3	0.48
29	6	96.0	0.00
27	9	103.2	2.10
27	10	112.3	5.69
27	11	123.2	9.17
27	12	126.9	9.39
Chickamin Mine		125.7	6.53
Lost C. Mine		127.1	11.5
20A	4	116.6	6.78
20A	3	94.8	0.04
2 RM	2	112.1	7.18
TP RM		121.8	15.3
2 RM	1	107.5	6.46
Channel S.		106.5	5.6
19A	14	107.0	
19A	13	97.8	
19A	9	97.1	
19A	12	95.9	
C.D. 3	5	99.8	0.29
27	13	134.0	8.74

HOLE NO.	SAMPLE NO.	DENSITY lb./ft ³	% Cr ₂ O ₃	HOLE NO.	SAMPLE NO.	DENSITY lb./ft ³	% Cr ₂ O ₃
2	1	103.3	4.4	TP7S	1	103.9	3.9
2	2	150.5	20.0	TP8S	1	106.0	11.0
2	3	109.2	5.0	TP9S	1	95.4	-
2	4	101.9	1.0	TP10S	1	109.8	5.1
2	5	98.9	0.5	TP18S	1	135.7	6.9
2	6	93.8	1.0	TP11S	1	92.0	2.5
1	3	93.5	0.5	TP11S	3	111.4	
1	2	105.3	2.6	TP12S	1	108.3	3.2
1	1	129.5	14.6	TP14S	1	101.0	12.1
3	1	90.8	0.4	TP19S	1	137.6	12.4
3	2	137.0	19.1	TP20S	1	114.9	4.3
3	3	106.2	5.1	TP20S	3	80.7	1.8
3	4	98.9	1.1	TP21S	1	101.8	1.6
4	1	94.4	0.4	18	6	100.3	0.0
4	2	96.9	0.3	21	9	107.8	4.6
4	3	96.3	1.0	21	8	99.6	1.8
4	4	97.1	1.0	21	10	117.0	6.7
4	5	95.8	1.3	21	11	129.3	11.0
4	6	95.8	1.2	21	13	123.3	8.5
4	7	89.8	0.9	21	14	125.7	7.8
5	1	101.5	3.2	21	15	116.2	4.7
5	2	110.0	7.9	C.D.1	12	127.0	3.9
5	3	100.0	0.7	23	7	85.7	0.3
6	1	129.4	15.7	23	10	132.1	12.0
6	2	117.1	6.7	23	11	129.5	10.1
6	3	105.5	2.5	23	12	139.5	13.5
6	4	105.2	2.6	23	8	103.0	0.8
7	2	102.0	1.4	23	9	116.3	7.1
7	3	103.0	1.0	21	12	115.3	7.3
TP3S	3	114.5	8.8	25	7	99.0	0.9
TP3S	2	117.7		25	8	99.3	0.6
TP3S	1	99.6		25	9	100.8	0.3
TP4S	1	111.1	7.7	25	10	115.7	4.4
TP2S	1	121.9	7.6	25	11	112.6	4.0
TP5S	1	98.9	-	25	12	95.7	Tr.
TP6S	1	119.2	9.2	25	13	89.9	0.1

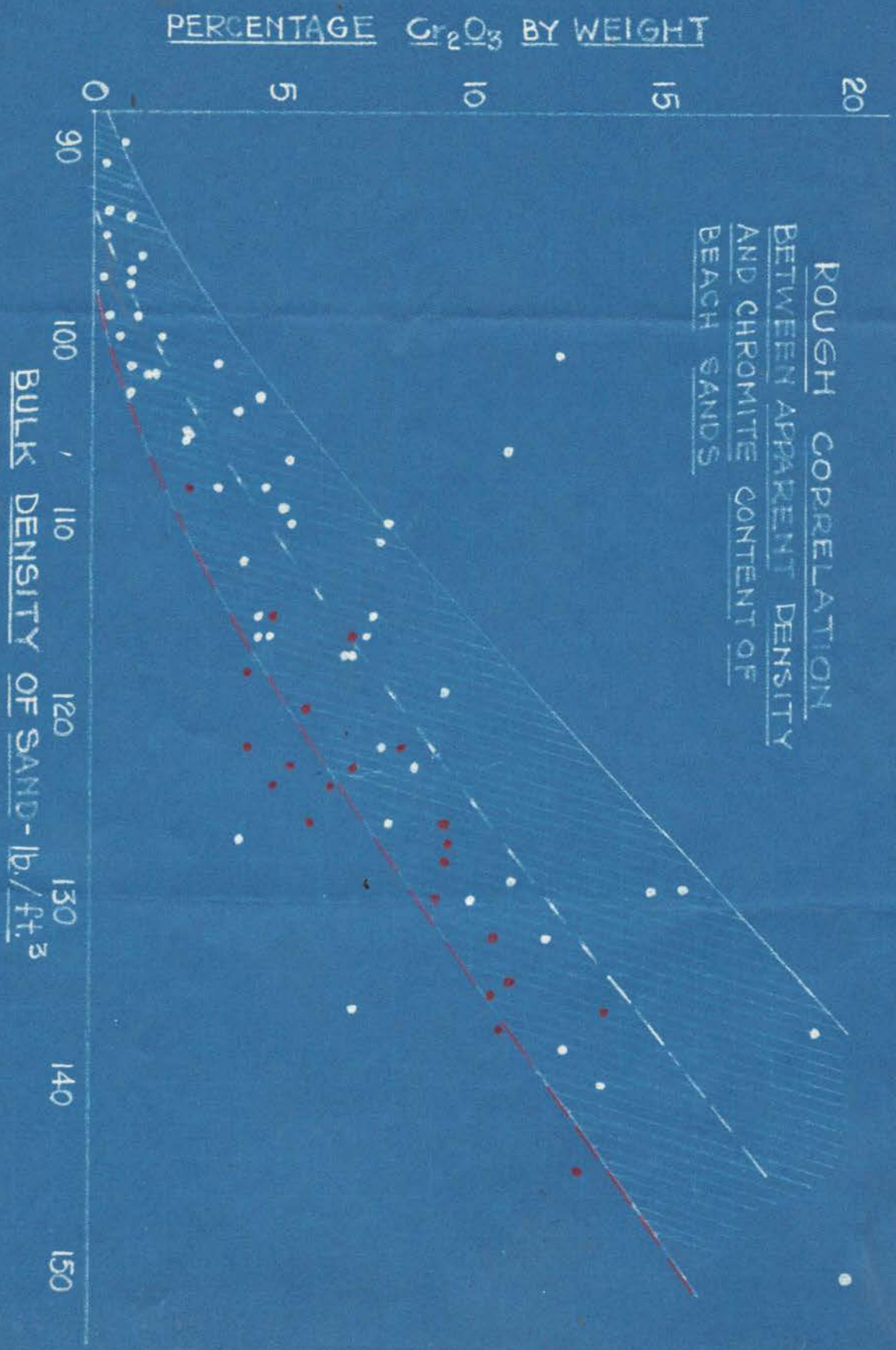
DR. 10-1-41	SCALE	CHEMICAL ENGINEERING	WORK ORDER NO.
CHK.	DATE		DRAWING NO.
APP.	10-1-41		SK-

RESULTS OF SPECIFIC GRAVITY MEASUREMENTS OF DRILL
HOLE SAMPLES FROM MARSHFIELD DRILLING PROGRAM

<u>Hole No.</u>	<u>Sample No.</u>	<u>Density</u> <u>Lb/Cu.Ft.</u>	<u>Percent by Weight</u> <u>Cr₂O₃</u>
16S	3	117.6	
16S	7	100.7	
16S	6	107.6	
16S	5	108.2	
16S	4	123.2	
16	11	108.6	1.3
16	10	103.5	1.3
16	12	107.7	1.2
C.D. 2	16	131.9	10.6
C.D. 2	14	128.0	9.2
C.D. 2	15	115.6	6.9
C.D. 2	13	107.0	1.0
C.D. 2	19	126.2	9.2
C.D. 2	18	135.8	13.5
C.D. 2	17	135.3	11.8
C.D. 6	14	120.3	5.5
C.D. 5	13	144.7	12.8
C.D. 5	12	130.2	8.98
C.D. 5	11	115.0	4.66
C.D. 6	15	121.6	4.03
C.D. 6	4	123.0	5.22
C.D. 6	19	122.2	3.42
C.D. 6	20	124.3	4.83
C.D. 6	13	107.6	2.52
C.D. 6	12	104.7	0.87
C.D. 6	17	124.3	6.11
C.D. 6	18	125.8	5.75
C.D. 6	16	118.6	4.00
C.D. 6	1	78.9	0.00
C.D. 6	2	89.8	0.00
C.D. 6	3	96.3	0.00
C. D. 7	1	95.8	0.03
C.D. 2A	10	106.2	2.10
C.D. 2A	13	118.0	6.13
C.D. 2A	6	97.2	0.00
C.D. 2A	8	97.5	0.00
C.D. 7	3	97.2	0.00
C.D. 7	4	94.8	0.00
C. D. 7	2	95.6	0.00
C.D. 7	5	91.2	0.00
C.D. 7	6	91.6	0.00

<u>Hole No.</u>	<u>Sample No.</u>	<u>Density</u> <u>Lb/Cu.Ft.</u>	<u>Percent by Weight</u> <u>Cr₂O₃</u>
18N	2	94.2	0.11
18N	1	96.8	0.64
18N	3	94.3	0.00
27A	19	123.0	6.89
27A	9	97.8	0.36
27A	15	135.0	11.5
27A	8	95.0	0.33
27A	14	126.9	9.31
27A	13	121.5	8.06
27A	16	137.0	11.8
27A	12	99.8	0.77
27A	6	89.8	0.20
27A	11	97.9	0.51
27A	10	97.2	0.37
27A	7	91.2	0.28

CHEMICAL ENGINEERING



SHEPARD PROPERTY

<u>Hole No.</u>	<u>Thickness</u>	<u>Weighted Av. Assay</u>	<u>Weighted Av. Density</u>
16 S	10'	3.0	111.4
19	9.4'	7.5	131.0
19 A	11.7' 12.7	1.7	99.0
20 a	4.1'	6.8	115.0
21	10.0'	6.4	120.0
21 a	7.0'	6.6	112.3
22	Barren - Hole not deep enough		
23	11.8'	7.4	121.0
24	8.2'	2.6	110.0
24 a	8.1'	4.5	113.0
25 O	7.3'	1.8	100.0
26 A	4.6'	6.6	108.0
27	4.5'	8.6	125.0
27 A	8.1'	10.6	130.0
29	19.0'	1.84	110.0
30 A	9.0'	12.4	121.0

<u>Test Pits</u>	<u>Sample No.</u>	<u>used in sections.</u>	
8	1	11.0	106.0
12	1	3.2	108.0
19	1	5.4'	110.0
21	1	2.5'	105.0
25		8.0'	110.0
20	1	3.2'	114.9
	2	2.7'	101.8
	3	1.0'	80.7

EAGLE PROPERTY

CD No. 1	10'	3.9	127.
2	8'	7.5	111.
5	8'	8.0	125.
6	9.5'	4.55	113.

ANALYSES OF CHROMITE SAMPLES FROM MARSHFIELD DRILLING UP
TO SEPTEMBER 12, 1941

<u>Property</u>	<u>Hole No. or Test Pit</u>	<u>Sample No.</u>	<u>% Cr₂O₃</u>
"Lagoons"	1	1	14.83
"	1	2	2.56
"	2	1	4.42
"	2	2	20.01
"	2	3	4.99
"	3	2	19.10
"	3	3	5.11
Bowman <i>Lagoons</i>	5	1	3.21
"	5	2	7.85
"	6	1	15.49
"	6	2	6.98
"	7	1	13.71
"	18S	1	0.69
"	18S	2	Tr.
"	18N	1	0.64
"	18N	2	0.11
"	18N	3	Tr.
<i>not</i> Chickamine Mine	--	Channel Sample	6.53
<i>"</i> Covert	16	10	1.34 ✓
"	16	11	1.27 ✓
"	16	12	1.18 ✓
"	16	13	0.04 ✓
Eagle Mine (Churn Drill)	1	10-13	3.92
"	2	13	0.97
"	2	14	9.20
"	2	15	6.94
"	2	16	10.63
"	2	17	11.79
"	2	18	13.54
"	2	19	9.16
<i>not</i> Lost Chance Mine	--	Channel Sample	11.47
<i>not</i> Refuge Mine	1 (Test Pit)	1	15.28 —
"	1	1	0.00 —
"	1	2	3.66 —
"	1	3	26.94 —
"	2	1	6.46
"	2	2	7.18
Schulein	SSW	1	10.53
"	NSW	1	16.08
"	ME	1	3.84
"	ME	2	0.05
"	ME	3	0.16
"	ME	4	0.16

<u>Property</u>	<u>Hole No. or Test Pit</u>	<u>Sample No.</u>	<u>% Cr₂O₃</u>
Schulein	ME	5	0.28
"	SE	1	4.28 ✓
"	NIE	1	0.33
"	NIE	2	5.16
"	8	1	10.33
"	8	2	19.22
"	8	3	14.18
"	9	1	13.05
"	9	2	18.87
"	9	3	12.73
"	9	4	8.93
"	10	1	12.18
"	10	2	16.07
"	10	3	5.12
"	10	4	2.78
"	11	1	20.92 ✓
"	11	2	13.86
"	11	3	9.14
"	11	4	8.26
"	11	5	12.10
"	11	6	9.63
"	11	7	6.18
"	11	3	7.90
"	12	1	0.67
Shepard	16S	3-7	3.29 ✓ Adams 3.0
"	19	7	4.90
"	19	8	6.23 ✓
"	19	9	11.93 ✓
"	19	10	9.78 ✓ E-19
"	19	11	11.72 ✓
"	19	12	6.33 ✓
"	19	13	3.86 ✓
"	19	14	6.45
"	19A	5-7	0.00
"	19A	9-14	1.69 ✓
"	20A	3	0.04
"	20A	4	6.78
"	21	8	1.79 ✓
"	21	9	4.64 ✓
"	21	10	6.65 ✓
"	21	11	11.03 ✓
"	21	12	7.34 ✓
"	21	13	8.51 ✓
"	21	14	7.80 ✓
"	21	15	4.66 ✓
"	21A	5,6	0.00
"	21A	7	1.32
"	21A	8	0.47
"	21A	9-13	0.00
"	21A	14	0.99

Property	Hole No. or Test Pit	Sample No.	% Cr ₂ O ₃
Shepard	23	7-13	5.29 5.1
"	24	3	2.30 ✓
"	24	4	3.40 ✓
"	24	5	2.77 ✓
"	24A	5	3.97 ✓
"	24A	6	5.86 ✓
"	24A	7	3.00 ✓
"	no check 25	9	0.29
"		10	4.35
"		11	3.99
"		25	1.76 1.5
"	26A	10	5.64 ✓
"	26A	11	7.27 ✓
"	26A	12	7.73 ✓
"	26A	13	7.26 ✓
"	26A	14	4.04 ✓
"	27	9	2.10
"	27A	6	0.20 ✓
"	27A	7	0.28 ✓
"	27A	8	0.33 ✓
"	27A	9	0.36 ✓
"	27A	10	0.37 ✓
"	27A	11	0.51 ✓
"	27A	12	0.77 ✓
"	27A	13	8.06 ✓
"	27A	14	9.31 ✓
"	27A	15	11.54 ✓
"	27A	16	11.79 ✓
"	27A	17	15.76 ✓
"	27A	18	8.67 ✓
"	27A	19	6.89 ✓
"	27A	20	6.31 ✓
"	27A	21	3.16 ✓
"	27	10	5.69 ✓
"	27	11	9.17 ✓
"	27	12	9.39 ✓
"	27	13	8.74 ✓
"	29	1	2.04 ✓
"	29	2	1.46 ✓
"	29	3	0.76 ✓
"	29	4	0.00 ✓
"	29	5	0.48 ✓
"	29	6	0.00 ✓
"	30A	1	12.45
"	30A	2	11.88
"	32	6	4.24 ✓
"	32	7	1.05 ✓
"	32	8	Tr. ✓

<u>Property</u>	<u>Hole No. or Test Pit</u>	<u>Sample No.</u>	<u>% Cr₂O₃</u>	<u>feet</u>
	<u>Test Pits</u>			
Shepard	2S	1	7.64	1.5'
"	3S	1-3	8.76	8.7'
"	4S	1	7.70	7.4'
"	5S	1-2	8.69	4.2'
"	6S	1	9.18	4.5'
"	7S	1	3.94	1.8'
"	8S	1	11.02	5.5 4.5'
"	8S	2	1.43	1.3' 1.3
"	9S	1-2	1.42	3.4' 5.8
"	10S	1	5.12	7.3 3.5
"	11S	1-3	2.54	7.3
"	12S	1	3.24	4.0
"	12S	2	2.31	3.4
"	14S	1	12.06	1.00
"	18S	1	6.85	6.00
"	19S	1	12.39	5.4'
"	20S	1	4.27	6.9' 3.2' }
"	20S	2	3.57	2.7
"	20S	3	1.78	1.0
"	21S	1	1.63	2.5
"	25	1	3.89	6.0
"	31	1	19.30	4.0
"	33	1	15.08	
	Tailings of Shepard Mine	1	8.89	
?	Test Pit <u>2.4</u>	Channel Sample	5.58	

OREGON STATE COLLEGE
SCHOOL OF ENGINEERING AND INDUSTRIAL ARTS
CORVALLIS, OREGON

DEPARTMENT OF
CHEMICAL ENGINEERING

November 3, 1941

FILE

Mr. F. W. Libbey,
Mining Engineer
State Department of Geology and Mineral Industries
702 Woodlark Building
Portland, Oregon

Dear Mr. Libbey:

Enclosed are the first density measurements upon the various hole samples of the Marshfield drilling program. A number of others have been completed and will be transmitted to you just as soon as they can be checked, which will be within the next day or so.

Very truly yours,

G. W. Gleeson

George W. Gleeson,
Professor of
Chemical Engineering

GWG:jn

117
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NOV 5 1941
STATE DEPT OF GEOLOGY
& MINERAL IND.

OREGON STATE COLLEGE
SCHOOL OF ENGINEERING AND INDUSTRIAL ARTS
CORVALLIS, OREGON

DEPARTMENT OF
CHEMICAL ENGINEERING

September 12, 1941

FILE

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SEP 13 1941
STATE DEPT OF GEOLOGY
& MINERAL INDS.

Mr. F. W. Libbey
State Department of Geology and Mineral Industries
702 Woodlark Building
Portland, Oregon

Dear Mr. Libbey:

In accordance with your request dated September 10, I am including a copy of all the analyses which we have made in connection with the Marshfield drilling program. As you realize, some of these analyses differ from those which were made by your department; but in the main the checks are reasonably good. We have repeated the analyses upon several samples where differences occurred and found that our results checked.

I shall make some specific gravity determinations upon the various sands in the Shepherd property and get those to you as soon as possible.

Very truly yours,


George W. Gleeson,
Professor of
Chemical Engineering

GWG:jn

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Em 1-

8' common gray sand
4.2 black & gray sands
4.2-4.7 - grey sand
4.7-5.6 - grey sand
5.6-6.9 - grey sand
6.4-7.4 - grey sand
7.4-8.3 grey sand
8.3-9.5 " "
9.5-10.4 " "

10.4-11.1 grey sand
11.1-12.2 Two small fragments of
~~12.2-13.~~ grey sand humus
and humus sludge
12.2-13.0 small amount of sand
& humus sludge
14.0 Humus

Bottomed

11.1
12.2
13.0
14.0

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CORVALLIS, OREGON

DEPARTMENT OF
CHEMICAL ENGINEERING

July 28, 1941

FILE

Mr. Allan B. Griggs
First National Bank Building
Marshfield, Oregon

Dear Mr. Griggs:

Returned empty sacks on July 24 by auto freight.

It was your wish to have the Cr_2O_3 analyses by each foot for some specific sample. I submit Hole Sample No. 21 results:

Hole 21

<u>Sample</u>	<u>Depth</u>	<u>% Cr_2O_3</u>
8	32.5-34.0	1.79
9	34.0-35.4	4.64
10	35.4-36.4	6.65
11	36.4-37.7	11.03
12	37.7-38.8	7.34
13	38.8-39.9	8.51
14	39.9-41.3	7.80
15	41.3-42.5	4.66

We find that at this date we have sheets for holes 22, 24, 26, but no samples and samples for holes 27 and 19A, but no sheets. Also we have no sheets for any of the test pit samples.

Also, we have received two Test Pit 6S, sample No. 1, one upon 6/28/41 and one upon 7/23/41. I assume there is some error in this duplication.

*→ This sample came from Tunnel at 6-S
80's from portal.*

We are still anxious to receive a plot of the hole locations. Also, have you made any decision as to a new line of holes in the lower Lagoons? We find that the holes so far do not enable us to make any reasonable three dimension estimate of the material. We would appreciate any word in this connection.

Sincerely,

G. W. Gleeson

George W. Gleeson,
Professor of
Chemical Engineering

GWG:jn
CC Mr. Earl K. Nixon

OREGON STATE COLLEGE
SCHOOL OF ENGINEERING AND INDUSTRIAL ARTS
CORVALLIS, OREGON

DEPARTMENT OF
CHEMICAL ENGINEERING

FILE

Mr. Allan B. Griggs
First National Bank Building
Marshfield, Oregon

Dear Mr. Griggs:

I am this morning returning to you 1/4 of the samples from the various test pits for which you did not save the U. S. G. S. portion. These samples have been screened to free them of oversized pebbles. Specifically, I present the following information for record, although such appears on the tags attached to the samples.

<u>Test Pit</u>	<u>Sample No.</u>	<u>Percent by Weight Pebbles</u>
3S	1	0
3S	2	0
3S	3	11.84
4S	1	0
6S	1	14.26
7S	1	0
8S	1	1.48
8S	2	3.25
9S	1	0
9S	2	5.91

According to your directions, the portion of the pebbles has not been returned since it is of no particular consequence.

The empty sample bags are being returned along with the test pit samples.

The shipment that was taken forward to Portland, which included Churn Drill Hole 2, was sent by mistake to Grants Pass. I have just written to have this shipment returned to us. I have no doubt but what it will be delivered intact.

We have not run the percentage of Cr_2O_3 on all of the samples. Our procedure has been to examine them under the microscope and if they justify analyses to make such. It was supposed to be the job

OREGON STATE COLLEGE
SCHOOL OF ENGINEERING AND INDUSTRIAL ARTS
CORVALLIS, OREGON

DEPARTMENT OF
CHEMICAL ENGINEERING

July 28, 1941

FILE

Mr. Allan Griggs
First National Bank Building
Marshfield, Oregon

Dear Mr. Griggs:

In addition to all previous analytical results, for your information and "unofficial," I submit the following:

<u>Hole No.</u>	<u>Sample No.</u>	<u>% by Wt. Cr₂O₃</u>
23	10	12.00
23	11	10.14
23	12	13.45
25	9	0.29
25	10	4.35
25	11	3.99
25	Ave. 7-13	1.76
5S	Composite	8.69
10S	1	5.12
11S	Composite	2.54
12S	1	3.24
12S	2	2.31
20S	1	4.27
20S	2	3.57
20S	3	1.78
19	Composite 10-13	3.92

I trust that these analyses in conjunction with the previous 48 may enable you to better outline your preliminary findings. This completes our efforts up to date.

Sincerely,

G. W. Gleeson

George W. Gleeson,
Professor of
Chemical Engineering

GWG:jn
CC Mr. E. K. Nixon

OREGON STATE COLLEGE
SCHOOL OF ENGINEERING AND INDUSTRIAL ARTS
CORVALLIS, OREGON

DEPARTMENT OF
CHEMICAL ENGINEERING

July 19, 1941

FILE

Mr. Allan Griggs
First National Bank Building
Marshfield, Oregon

Dear Mr. Griggs:

As per your previous request, I am submitting below the analyses for Cr_2O_3 upon the various drill samples. I assume that you will consider these results confidential, since they are not "official" and have been run as control checks.

<u>Hole No.</u>	<u>Sample No.</u>	<u>Percent by Weight Cr_2O_3</u>
1	1	14.8
1	2	2.6
2	1	4.4
2	2	20.0
2	3	5.0
3	2	19.1
3	3	5.1
4	Considered barren	
5	1	3.2
5	2	7.9
6	1	15.5
6	2	7.0
7	Considered barren	
8	1	10.3
8	2	19.2
8	3	14.2
9	1	13.1
9	2	18.9
9	3	12.7
9	4	8.9
10	1	12.2
10	2	16.1
10	3	5.1
10	4	2.8
11	1	20.9
11	2	13.9
11	3	9.1
11	4	8.3

copied and sent to F G Wells 7-21-41

Mr. Allan Griggs--2
July 19, 1941

<u>Hole No.</u>	<u>Sample No.</u>	<u>Percent by Weight Cr₂O₃</u>
11	5	12.1
11	6	9.6
11	7	6.2
11	8	7.9
12	1	.7
2S	1	7.6
3S	Composite	8.8
4S	1	7.7
6S	1	9.2
7S	1	3.9
9S	Composite	1.4
19S	1	12.4
21S	1	1.6
CD1	Composite 10, 11, 12, 13	3.9

The above is as far as our analyses have progressed to date and are presented to you for the purpose of making it possible for you judge the outline of the deposit or anticipate the location of additional holes.

You will note from the results that the concentrations in the properties indicated under the name of Schulein ran high in chromic oxide. Therefore, we are particularly anxious to obtain additional holes in this area. If further drillings can be made or are anticipated, we would appreciate word of it.

I have received your most recent letter and I believe all of the sample shipments have arrived in satisfactory manner. We are busy checking on them at the present time. We look forward to a copy of the map which will give us some idea of the direction in which we are traveling.

Sincerely,

G. W. Gleeson

George W. Gleeson,
Professor of
Chemical Engineering

GWG:jn
CC Mr. E. K. Nixon

OREGON STATE COLLEGE
SCHOOL OF ENGINEERING AND INDUSTRIAL ARTS
CORVALLIS, OREGON

DEPARTMENT OF
CHEMICAL ENGINEERING

August 16, 1941

FILE

✓ Mr. F. W. Libbey,
Mining Engineer
State Department of Geology and Mineral Industries
702 Woodlark Building
Portland, Oregon

Dear Mr. Libbey:

In connection with the discrepancies that existed between our analyses and those of the State Assay Office on the chromite samples, we have re-checked, and I submit the following:

Hole No.	Sample No.	Percent Cr ₂ O ₃ <u>Rechecked</u>	Percent Cr ₂ O ₃ <u>State Office</u>
2	1	4.42	2.34
		4.89	
		Average 4.66	
3	2	19.10	0.02
		19.22	
		Average 19.16	
9	2	18.87	9.49
		18.75	
		Average 18.81	
9	3	12.73	5.79
		11.74	
		Average 12.25	

by Al Lewis

It is evident from the above analyses that a mix-up must have taken place in the samples which were submitted to the State Assay Office, since there is no evidence that the samples are in any manner confused on this end.

We have also taken the opportunity to check on the effect of manganese in the sand samples. We find that unless manganese is taken care of, the analyses may run high. In all instances where it shows up, we have added sufficient acid to take care of manganese percentage. This is something which might be called to the attention of Adams, if he is still working on the samples.

Very truly yours,

George W. Gleeson

George W. Gleeson,
Professor of
Chemical Engineering

GWG:jn

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STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

702 WOODLARK BUILDING
PORTLAND, OREGON

CHROMIUM DETERMINATIONS ON
BEACH SAND SAMPLES
July 29, 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
JUL 30 1941

STATE DEPT OF GEOLOGY
& MINERAL INDS.

<u>Office Number</u>	<u>Drill</u>	<u>Hole Number</u>	<u>Sample Number</u>	<u>Chromic Oxide</u>
BG-684	Empire	1	1	14.60
BG-685	Empire	1	2	2.43
BG-686	Empire	1	3	0.49
BG-687	Empire	2	1	2.34
BG-688	Empire	2	2	20.00
BG-689	Empire	2	3	4.86
BG-690	Empire	2	4	0.97
BG-691	Empire	2	5	0.49
BG-692	Empire	2	6	0.97
BG-693	Empire	3	1	0.38
BG-694	Empire	3	2	0.02
BG-695	Empire	3	3	4.14
BG-696	Empire	3	4	1.06
BG-697	Empire	4	1	0.38
BG-698	Empire	4	2	0.29
BG-699	Empire	4	3	0.96
BG-700	Empire	4	4	0.96

*these assays
have not been
checked*

STATE GOVERNING BOARD
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METALLURGICAL CHEMIST



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PORTLAND, OREGON

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ASSAYER

2102 COURT ST., BAKER

HUGH K. LANCASTER
FIELD ENGINEER

WILLIAM T. BURNS
ASSAYER

CHROMIUM DETERMINATIONS ON BEACH SAND SAMPLES July 29, 1941

<u>Office Number</u>	<u>Drill</u>	<u>Hole Number</u>	<u>Sample Number</u>	<u>Chromic Oxide</u>	
BG-701	Empire	4	5	1.25	
BG-702	Empire	4	6	1.15	
BG-703	Empire	4	7	0.87	
BG-704	Empire	5	1	2.40	
BG-705	Empire	5	2	7.15	
BG-706	Empire	5	3	0.65	
BG-707	Empire	6	1	15.70	
BG-708	Empire	6	2	6.71	
BG-709	Empire	6	3	2.46	
BG-710	Empire	6	4	2.62	
BG-711	Empire	7	2	1.58	
BG-712	Empire	7	3	1.01	
BG-713	Empire	8	1	9.80	
BG-714	Empire	8	2	20.01	
BG-715	Empire	8	3	13.80	
BG-716	Empire	9	1	11.90	13.1
BG-717	Empire	9	2	9.49	18.9
BG-718	Empire	9	3	5.79	12.7

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STATE DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

702 WOODLARK BUILDING
PORTLAND, OREGON

CHROMIUM DETERMINATIONS ON
BEACH SAND SAMPLES
JULY 29, 1941

RECEIVED
JUL 30 1941

STATE DEPT OF GEOLOGY
& MINERAL INDS.

STATE ASSAY LABORATORIES
400 E. 1 ST., GRANTS PASS
RAY C. TREASHER
FIELD GEOLOGIST
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FIELD ENGINEER

WILLIAM T. BURNS
ASSAYER

<u>Office Number</u>	<u>Drill</u>	<u>Hole Number</u>	<u>Sample Number</u>	<u>Chromic Oxide</u>	
BG-719	Empire	9	4	8.46	8.9
BG-720	Empire	10	1	12.12	12.2
BG-721	Empire	10	2	15.82	16.1
BG-722	Empire	10	3	3.84	5.1
BG-723	Empire	10	4	1.88	2.8
BG-724	Empire	11	1	20.75	20.9
BG-725	Empire	11	2	13.50	13.9
BG-726	Unknown Portion	11	3	6.61	9.1
BG-727	Empire	11	3	8.50	
BG-728	Empire	11	4	8.05	8.3
BG-729	Empire	11	5	11.90	
BG-730	Empire	11	6	9.49	
BG-731	Empire	11	7	5.79	
BG-732	Empire	12	1	0.85	
BG-733	Churn	1	10	0.34	
BG-734	Churn	1	11	4.29	
BG-735	Churn	1	12	3.89	
BG-736	Churn	1	13	2.56	

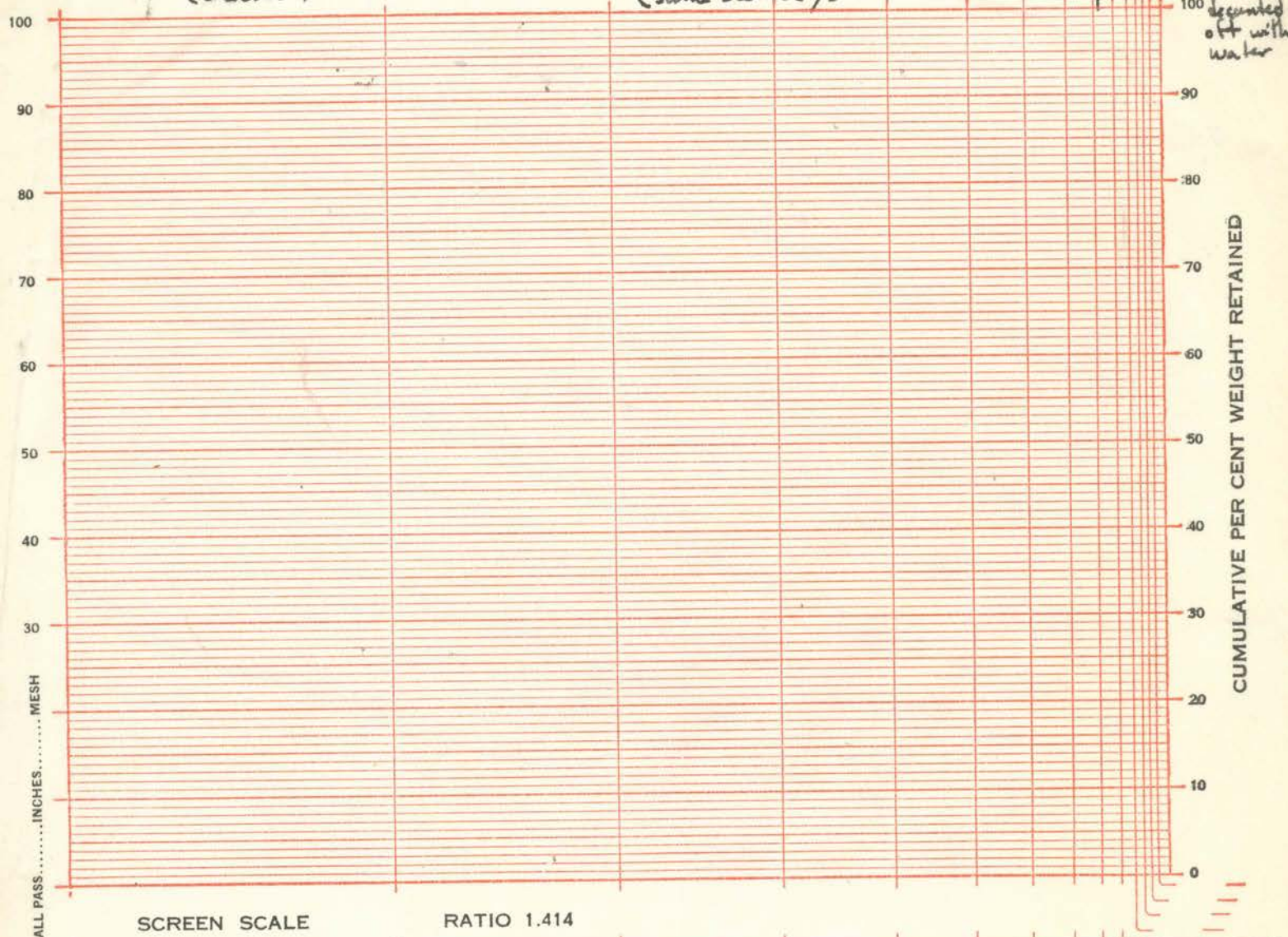
Albert C. Lewis
Analyst

Form No. L-4
Please mention above
when ordering

Name P-5380 - DOGAMI
(washed)

Date Oct. 25, 1946

Date Oct. 25, 1946
(sand scoured $\frac{1}{2}$ hr in ball mill + clay and fine particles
settled off with water)

[illegible]

Weight before screening 122.0 g.

OREGON STATE UNIVERSITY
SCHOOL OF ENGINEERING
CORVALLIS, OREGON

RECEIVED
MAY 25 1961
STATE DEPT. OF GEOLOGY
& MINERAL IND.

OFFICE OF THE DEAN
COVELL 201

May 24, 1961

Mr. Hollis Dole
State Department of Geology & Mineral Industries
State Office Building
Portland, Oregon

Dear Mr. Dole:

Since talking to you the other day, I have reviewed quickly the known black sand deposits in Seven Devils area. My metallurgy shows a safe recovery value at 80% Cr_2O_3 in producing a 38-39% Cr_2O_3 concentrate. Recovery results will be better than 80% on some deposits and a concentrate better than 40% Cr_2O_3 on some; however, the above figures are safe and definitely possible so estimates were calculated on the 80% recovery basis. In terms of this grade and recovery the following estimates have been compiled.

(1) Section 10 South Ore Body (Muchow) 39,000 short tons with a little probable in addition.

(2) Section 33 (Moore and Vaughan) 64,000 short tons. Some small undrilled area remains but probable ore not large.

(3) Section 4 drilled and proven tonnage 28,000 short tons.

(4) Extension of Section 4 - North Ore Body No. 3 shows probable ore of 100,000 short tons. Drilling was never completed upon this area, but for the area drilled, the above amount is indicated with a probability of an additional 50,000 tons for fringes outside of actual drilled area.

(5) The so-called North Ore Body of Section 10 is broken into two parts No. 1 and No. 2 (Muchow). Ore Body No. 1 appears to be relatively barren and such blacks as are present are at too great a depth to dig for what is there. Ore Body No. 2 has ore but has never been completely drilled out. It will develop less tonnage than Section 10 South Ore Body. A good guess would be 20,000 short tons.

In total, the ore known to exist and either well or moderately well drilled shows:

Section 10 South	39,000	
Section 33	64,000	
Section 4	28,000	
Section 4 Ext.	<u>100,000</u>	231,000
Probable		<u>70,000</u>
Total		301,000 short tons at 39% Cr_2O_3 80% recovery



Mr. Hollis Dole - 2

For a moderately economical size plant of 30,000 short tons of concentrate per year, it appears that a ten-year run is reasonably certain in the Seven Devils area without going to the lower elevations.

There are other areas which should be prospected. I know of at least two.

You will recall that we talked of the "Brass Mine" research. The process of Chemmetals for a high pressure ammonia leach of mixed sulphide ores of copper, zinc and lead followed by oxidation and reduction appears to be promising, particularly if combined with electrolysis. Ammonium sulphate is a byproduct. Copper precipitates directly and in pure form. Zinc and lead can be subsequently separated. Hope that at some time or another I have a chance to try this process on local ores.

Hurriedly,

A handwritten signature in blue ink, appearing to read "G. W. Gleeson".

G. W. Gleeson
Dean

GWG:EH

Firm To Build Plant To 'Mine' Black Sand

OLYMPIA (UPI) — Development of a new industry in the Pacific Northwest through extraction of minerals from the vast deposits of "black sand" at the mouth of the Columbia River was announced

here Thursday.

Officials of the Washington Minerals Profit Corp., Tacoma, announced ground breaking for the plant near Ilwaco for commercial processing of the deposits.

(THE ANNOUNCEMENT from the Washington side of the river follows a flurry of about three and a half years ago when several firms sought to bid on Oregon delta lands.

(At that time the main consideration was for extraction primarily of iron from the sands, but many problems, including disputed ownership of the sands on the Oregon side, prevented final action.)

John H. McLaughlin, Lincoln, Neb., president of the firm, said the plant will utilize a new process to recover iron, garnet and silica from free sands pumped from the Baker Bay area of Pacific County.

He said the company plans to have the first unit of the plant in operation by July. Its initial capacity of 5,000 cubic yards per day will represent an investment in excess of \$1-million.

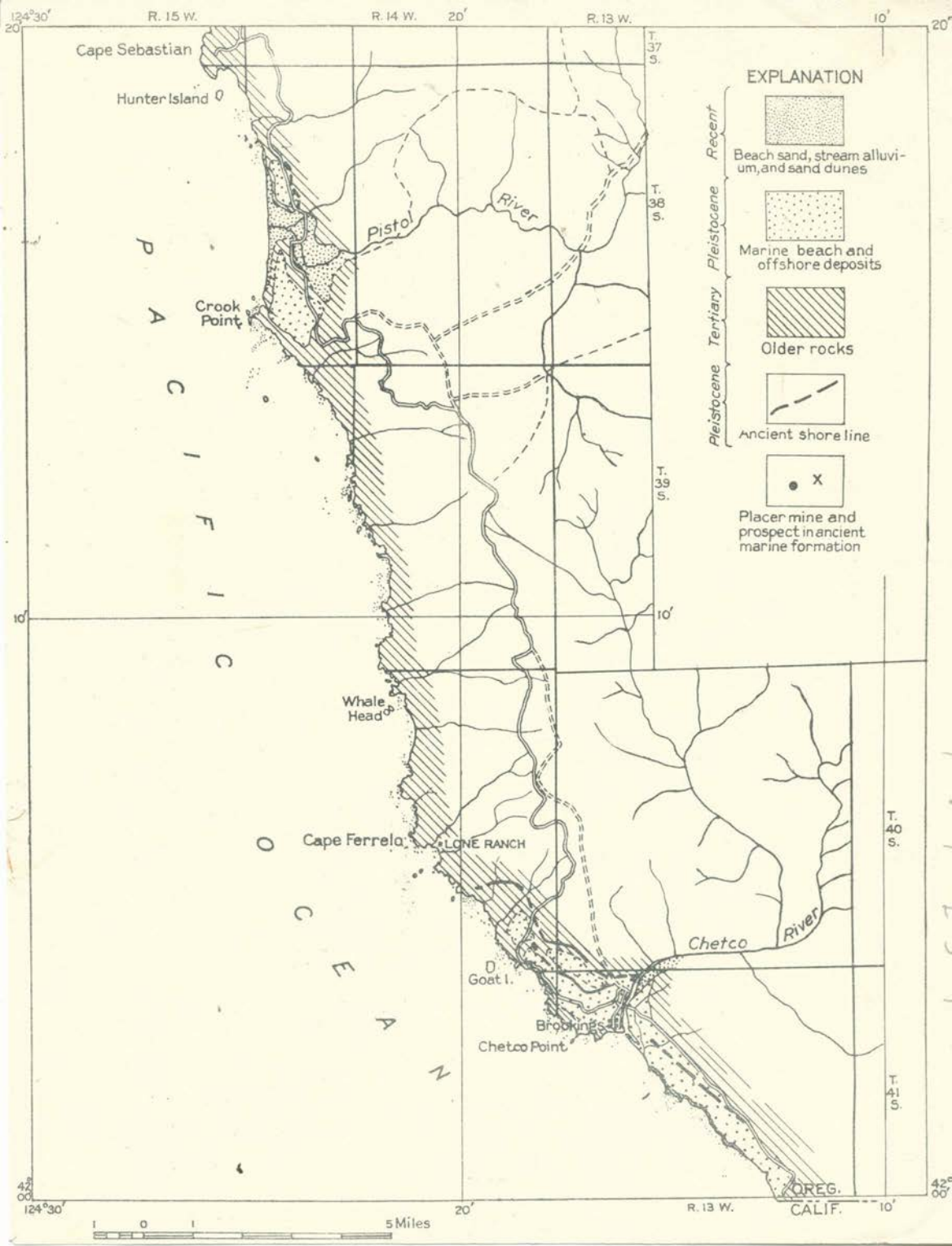
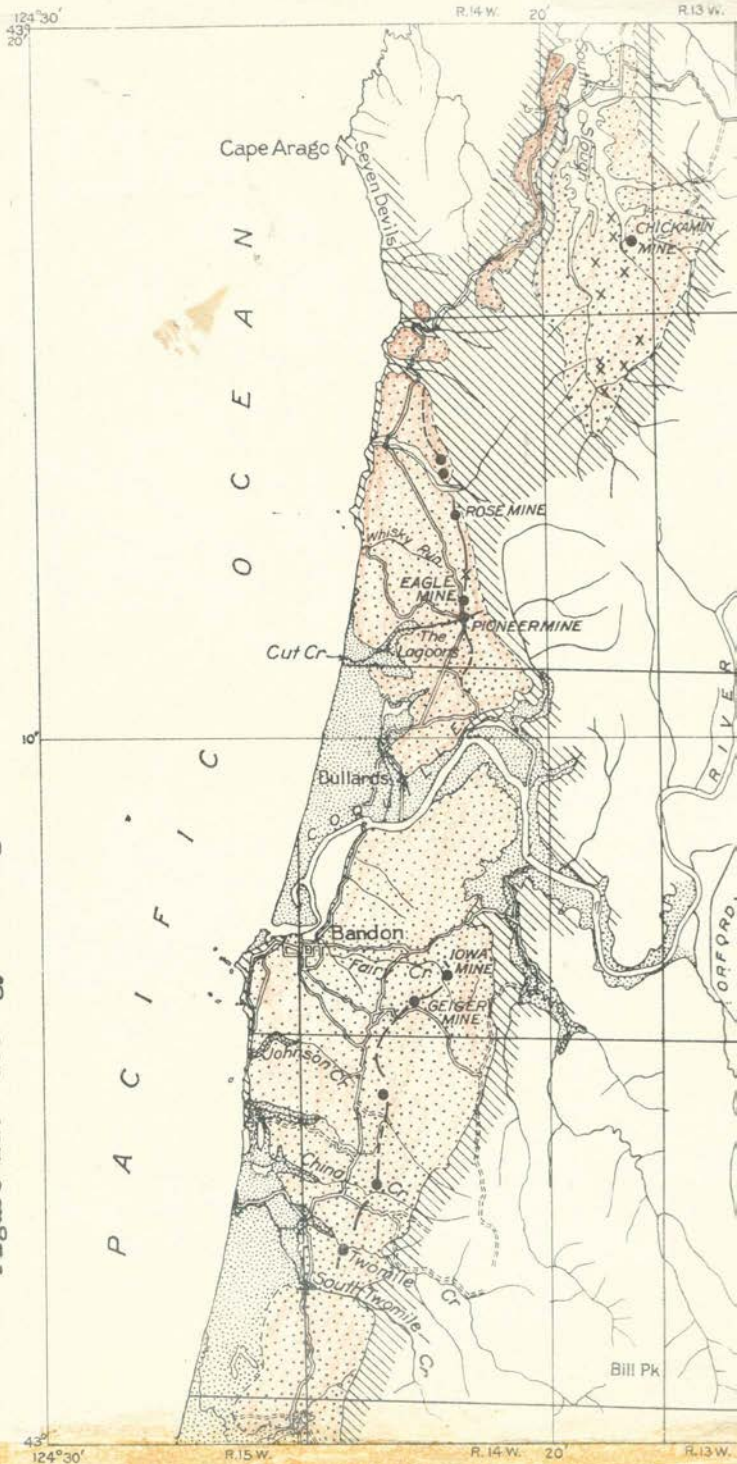


Figure 2a.- Geology of Oregon coast south of Coos Bay (north half).



assigned to projects for the remainder of the biennium. If we were to embark on this project, it would be necessary to go to the Emergency Board for funds and to hire new personnel. It would be our suggestion that you contact the U. S. Bureau of Mines. This is not in any way trying to duck the responsibility, but because the black sands occur both in Oregon and Washington we feel that the whole area should be studied rather than that here in Oregon alone. We feel also that a joint effort by our Department and the Washington Bureau of Mines would be so unwieldy that too much time would be consumed in completing the project. The Bureau of Mines, on the other hand, has mining engineers, drillers, and possibly drill rigs. They are ^{fully} capable of doing the project, and they have no state boundary restrictions. If you would care to investigate this with them, I would suggest that you contact Mr. Mark Wright, Director, Box 492, Albany.

If there is any more information needed on this, we would be pleased to have you contact us, or if you would like to have us drop down to your office or appear before your Committee, we will be most happy to do so.

Sincerely yours,

H. M. Dole
Director

HMD:lk

Encl. E.

cc Richard/Groener, Chairman
15014 S.E. Woodland Way
Milwaukie 22, Oregon

cc (not noted) - to Dan Allen

ESTIMATE FOR EXPLORATION OF SANDS NEAR MOUTH OF COLUMBIA RIVER

A. Quantity survey

1. Preliminary investigation (one month) - Total \$16,000-\$20,000

a. Onshore

- (1) Salaries (one engineer and three drillers) - \$3,000
- (2) Analyses, drafting, and report writing - 1,000

b. Offshore (in harbor mouth)

- (1) Rent of barge - 3,000
- (2) Rent of drilling rig - 5,000
- (3) Surveying - 3,000
- (4) Analyses, drafting, and report writing - 1,000

2. Close drilling (one to two months) - Total \$15,000-\$30,000

- a. This part of the project to be done only if the preliminary investigation indicates that it is warranted.
- b. Estimate of cost depends on amount of drilling necessary from findings of preliminary investigation.

B. Metallurgy

- 1. U. S. Bureau of Mines, Albany, has done some metallurgical work on this type of material. Probably further work will be required in light of improved technologies since the first work was done.
- 2. Cost of this is unknown.

C. Market survey

1. If the quantity and metallurgical study indicates that there is a sufficient amount of material present and that the metallurgy is favorable, a survey will be required to determine the market potential and the market area.
2. In comparison with surveys made in the past on similar materials, it would be our estimate that the cost would be from \$5,000-\$10,000.

D. Preliminary mining

1. This undoubtedly would be in the province of any company interested in the development of these sands and would be in response to favorable results of "A", "B", and "C" noted above.
2. In the event the Small Business Committee would be interested in the cost of this, we have come up with an estimate of \$150,000.
3. Purpose of this part of the program would be to determine what methods of mining would be most suitable and to arrive at costs prior to the installation of a major plant.

TO: GMI Staff
FROM: RSM

April 23, 1962

RE: Black sand market

Here is a possible outlet for those miners who have black sand and don't know what to do with it.

Russell Chadwick, Rt. 1, Box 544, Beaverton, phone Mitchell-6 1092 (eve) or Atlantic-8 4581 (days) will pay \$20/ton dlvd Beaverton for any black sand or lumps which weigh at least 1850 lbs. per 55 gallon steel drum, weight of drum included.

Chadwick can use up to 160 tons a year but must be contacted first before any deliveries are made. This is not a very attractive price and there may be some difficulty in reaching the minimum weight, which calculates out to about a specific gravity of 4, with a theoretical of 5 for pure, solid magnetite.

OREGON STATE COLLEGE
SCHOOL OF ENGINEERING AND INDUSTRIAL ARTS
CORVALLIS, OREGON

OFFICE OF THE DEAN

MAY 1, 1951

MR. ROBERT MARSHALL, JR.
3636 NE 63 AVENUE
PORTLAND 13, 1951

DEAR MR. MARSHALL:

SINCE I DID NOT PICK UP ANY COPIES OF THE PAPER ON THE BLACK SANDS AS GIVEN BEFORE THE NORTH-WEST INDUSTRIAL MINERALS CONFERENCE, I AM SENDING A COPY OF THIS LETTER TO RALPH MASON WITH THE EXPECTATION THAT HE WILL PROVIDE A COPY OF THE PAPER.

WE PAID BUT LITTLE ATTENTION TO NOBLE METAL VALUES IN THE DRILL HOLE SAMPLES ALTHOUGH WE MADE A FEW ASSAYS, SOME OF WHICH RAN AS HIGH AS \$2.50/YD OF MATERIAL IN PLACE. OBVIOUSLY, WHAT VALUES ARE PRESENT WILL CONCENTRATE WITH THE HEAVY MINERALS. I DID TAKE A HIGH CUT OFF OF THE FIRST THROUGH SPIGOTS OF ONE BANK OF SIX SPIRALS AND RAN IT OVER AN AMALGAMATED PLATE. THE FEED WAS FROM THE LAGOONS WHICH REPRESENTED TAILINGS FROM THE OLD PIONEER OPERATIONS WHICH HAD ALREADY BEEN WORKED FOR GOLD. THE ESTIMATED THROUGH PUT WAS 6300 TONS OF MATERIAL, AND THE VALUE RECEIVED FOR THE SPONGE WAS \$800 SO THE VALUES RAN ABOUT 13 CENTS PER YARD. THE VALUES HAD PROBABLY BEEN ALREADY AMALGAMATED AND UNDOUBTEDLY REPRESENTED IN LARGE PART AMALGAM LOSSES FROM THE PIONEER OPERATION. SINCE THE LAGOONS MATERIAL WAS A CONCENTRATE OF UNKNOWN AMOUNT, NO CHECK BACK CAN BE MADE AS TO VALUES IN PLACE. HOWEVER, WE ARE AWARE THAT LARGE BLOCKS OF THE MATERIAL WERE CONSIDERED TO AVERAGE ABOUT 20 CENTS/YD IN PLACE WHICH DOES NOT SEEM UNREASONABLE.

AS YOU MAY ALREADY KNOW, THE GOLD IS FINE AND FLAT AND IN MANY INSTANCES BADLY COATED. THESE CIRCUMSTANCES MAKE RECOVERY DIFFICULT.

C O P Y

14

Mr. ROBERT MARSHALL, JR.

MAY 1, 1951

PAGE 2

IF YOU ARE ACQUAINTED WITH THE SHEPARD PROPERTY, WE HAVE VALUES OF \$0.17/YD FROM PIT No. 20, \$0.34/YD FROM PIT No. 19, \$0.17/YD FROM PIT No. 5, \$1.05 FROM PIT No. 31, \$0.35 FROM LINE 6 HOLE 2, \$0.17/YD FROM TUNNEL, BARREN PIT No. 3, BARREN PIT No. 27, BARREN PIT No. 18, BARREN PIT No. 28, \$0.17/YD FROM PIT No. 17, BARREN PIT No. 11.

AT ONE TIME WE PRODUCED A ZIRCON CONCENTRATE FROM THE MAGNETIC TAILINGS BY GRAVITY CONCENTRATION. THIS FINAL MATERIAL ASSAYED \$54.60/TON WHICH, CHECKED BACK TO THE ORIGINAL MATERIAL, WOULD HAVE BEEN $\frac{1}{160}$ OF THIS VALUE PER YARD OR ABOUT \$0.34.

IT IS MY OPINION THAT IT WOULD PAY TO MAINTAIN A GOLD RECOVERY CIRCUIT IN CONNECTION WITH ANY OPERATION WHICH WAS RECOVERING OTHER HEAVY MINERAL, BUT I DO NOT BELIEVE A GOLD OPERATION COULD BE SUSTAINED BY ITSELF.

VERY TRULY YOURS,

G. W. Gleeson

G. W. GLEESON
DEAN

GWG:O

CC Mr. RALPH MASON

COPY

STATE DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

1069 STATE OFFICE BUILDING
PORTLAND 1, OREGON

April 24, 1962

To: Staff
From: R. S. Mason
Subject: Black sand market

Here is a possible outlet for those miners who have black sand and don't know what to do with it.

Russell Chadwick, Route 1, Box 544, Beaverton - phone Mitchell 6-1092 (evenings) or Atlantic 8-4581 (days) will pay \$20/ton delivered Beaverton for any black sand or lumps which weigh at least 1850 pounds per 55-gallon steel drum, weight of drum included.

Chadwick can use up to 100 tons a year but must be contacted first before any deliveries are made. This is not a very attractive price and there may be some difficulty in reaching the minimum weight, which calculates out to about a specific gravity of 4, with a theoretical of 5 for pure, solid magnetite.

RSM:lk

Sept. 28 1962

Hollis:

John J. Theissen, a consultant, formerly with the mining division of Yuba Dredging was in today. Theissen is checking into the possibility of establishing a direct reduction plant to treat off-shore and domestic magnetites.

The presence of ilmenite and other titaniferous minerals apparently poses no problem with a new method just now coming out of the pilot stage. Large amounts of low cost power are required--hence the interest in this area. If enough titanium is present a very high grade Ti slag can be made and sold at a premium, leaving the Fe pure and locally saleable.

I clued Theissen in on our thinking re the lower Columbia and also mentioned the black sands in Coos County.

r.

MAGNETITE
SAND

WJ Min News

10-3-60

TO: HMD
FROM: RSM

RE: Vitro Chemical

Mr. Robert Wilson of Vitro's Heavy Minerals Company was in to inquire about the land ownership along the south shore of the Columbia in the general vicinity of Fort Stevens. It seems that Virto has taken over the Columbia Titanium holdings across the river and want to protect their holdings as completely as possible. Vitro is thinking of building a \$55 million plant to beneficiate the sand, using a series of wet concentration methods. They are mainly interested in recovering magnetite but will try for everything else including quartz. The iron can be used in heavy density concretes and perhaps some will be exported. The silica is scheduled to go into Roc-Block and Roc-Board which are made of silica, lime and aluminum powder (Ore.-Bin April 1956) Mr. Wilson gave no indication when they might get under way, and I gathered that basic data is still being collected.

A by-product of the visit was the discovery that Vitro is all set to ship iron ore from Helena to Seattle for boating to Japan. I asked him if he had checked the Portland shipping freight handling facilities (he hadn't), gave him our Sept. Ore.-Bin article on the port and got him in touch with Tom Guerin. After he left I called Guerin's office and tipped them off. In a later phone conversation with Wilson he said that he was inspecting the ore handling facilities with Guerin tomorrow.

R

Black Sands

7-21-60

TO: HMD
FROM: RSM

Keith Miller, Oregon Steel, was in this morning. Oregon Steel has been and still is very interested in domestic, west coast iron ores. Keith has looked up in Canada, Washington, Oregon and other places for deposits of 10 to 20 million tons which they could acquire.

He has Mr. Roth and associates pegged, but is still interested in black sands provided they are large enough to permit amortization of a 6 to 10 million dollar plant investment. They have been corresponding with ALCOA over the years but have gotten nowhere. At the present they are investigating both Strategic-Udy and RN processes. The high titanium is a problem but it is felt that some direct reduction scheme will solve it.

They have considered the possibility of combining coastal black sands for part of their needs with ALCOA's reject iron slurry. If they did this they might have to modify their flow sheet somewhat from a straight black sand feed.

Oregon Steel has committed itself to nothing as yet, but they are definitely interested since the scrap picture will worsen in the future (interestingly enough the worsening is not tonnage wise but because of high copper and nickel).

Perhaps the Westvaco interest in chrome from the sands might fit into the picture.

BLACK SANDS

7-19-60

TO: HMD
FROM: RSM

Mr. W.A. Young, Mineral Development Dept. of the Chemical Divisions of Food Machinery and Chemical Corp. (Westvaco) was in the office on the 15th. They are interested in the possibility of obtaining up to 35,000 ton/year of 40% 2:1 chrome for a projected (and confidential) plant at their Wyoming works.

They are interested in either operating their own mines and mill in eastern Oregon or if enough substantial tonnage could be developed independently they would be glad to enter into long term contracts.

The Montana situation has already been examined. Oddly enough the freight from the deposits there is almost identical to that from Seneca. Montana is attractive in that sufficient tonnage exists in easily mined deposits. The grade is not so attractive and that is why they are looking out this way.

Although they have not progressed far enough as yet, the figure of \$20 a ton at the plant in John Day was offered as a possibility. Some interest in the Black Sands was shown also.

8-16-61

TO: HMD
FROM: RSM

SUBJECT: Sand Island

Here are two analyses of the mineral content of the black sands on Sand Island near the mouth of the Columbia River. "Heavies" only given.

Garnet	1.00 %	2.33%
Zircon	rare	rare
Magnetite	78.28	20.33
Ilmenite-		
chromite	15.80	27.53

Both samples taken at upstream end of island by Twenhofel, (GMI Bull 30) Twenhofel (op cit) also says:

"Sand Island in the Columbia River is composed entirely of sand and driftwood. The island has been made by river deposition, and it is said to have increased in area since the building of the jetties. There are very rich concentrations of black mineral particles on sand Island, particularly on the south side. The concentrations were seen in the high and upper mid tidal zones and there may be much beneath the vegetation which covers most of the island. There is a very rich concentration of black sand on the upstream side the island on both sides of the old docks and on the south side to the trestle connecting the main or west part of the island. Concentration is very rich on the south side of the dock; less on the north side. The main part of the island has excellent concentration on the south side, very poor on the north side - the side toward the mainland of Washington. The sands of the island are everywhere filled with driftwood and this wood seems to be more abundant in places where the black sand concentration is greatest. There must be thousands of tons of magnetic black sands on Sand Island."

Robert Wilson of N.W Iron & Steel says he is interested in Sand Island but would be just as happy if not more so if Washington obtained it. He has leases all along the Columbia from the mouth to a point roughly 8 miles upstream from Megler. He also said that he was getting a big run-around from the Land Board in Salem.

Lloyd Ruff said Sand Island had a lot of piles and driftwood and probably a lot of sand at or just below low tide level. He also said that the Army would object to backfilling in the channel but would be happy to have some of the in-channel bars dredged--and pumped somewhere else.

State Department of Geology and Mineral Industries

702 Woodlark Building
Portland, Oregon

PETROGRAPHIC NOTES* ON SAMPLES OF OREGON COASTAL SANDS COLLECTED BY RAYMOND LADOO AND EWART BALDWIN

W. D. Lowry

Sample P-5037 (field sample no. 1)

From Gearhart Beach just north of Seaside, Oregon. Sample taken opposite Ocean Hotel overlooking sea. Approximately 40 feet above sea level.

A. Shape of grains: Subangular to subrounded.

B. Count:

Total number of grains	343
Quartz grains	41
Other minerals or rocks identified:	
1. Magnetite	
2. Plagioclase, some with numerous inclusions	
3. Chalcedonic grains (4 grains) 1 with dark brown masses	
4. Hornblende	
5. Tremolite	
6. Microcline, some sericitic	
7. Muscovite	
8. Basic lava fragments, some with plagioclase phenocrysts - very common	

C. Varieties of quartz grains:

1. Clear
2. With negative and fluidal inclusions
3. Aggregate grains
4. With inclusions of biotite, rutile (?), or zircon

D. Summary:

Quartz content	10-15%
Chalcedonic grains	1 ±
Feldspar and basic lava grains	Very common

* The error in sampling these sands for petrographic study must be taken into account. Also as some of the plagioclase has an index of refraction near that of quartz, some plagioclase grains may have been counted and the quartz content given may be high.

Sample P-5038 (field sample no. 2)

Road to north end of Gearhart Beach about 1 mile from ocean.
Sample taken from an excavation in the 3rd or 4th dune ridge.

A. Shape of grains: Subangular

B. Count:

Total number of grains	281
Quartz grains, some aggregate	52
Other mineral or rock grains identified:	
1. Plagioclase including many yellowish grains	
2. Augite	
3. Tourmaline (?)	
4. Many lithic fragments including basic lava	

C. Summary:

Quartz content $20 \pm \%$

Inclusions in quartz grains examined don't seem much more common than in the other sample. Most of the light-colored, including yellowish, grains are not quartz.

Sample P-5039 (field sample no. 3)

Just west of Sunset Beach, 2nd dune from sea at south end of Astoria Golf Club course.

A. Shape of grains: Subangular

B. Count:

Total number of grains	238
Quartz grains	35
Other grains identified:	
1. Plagioclase, many are yellowish	
2. Microcline	
3. Hornblende	
4. Lithic fragments, very common	

C. Summary:

Quartz content $15 \pm \%$

Inclusions in quartz grains examined under high power don't seem more common than in other coastal sands. Yellowish and light-colored grains are predominantly feldspar.

Sample P-5040 (field sample no. 4)

About 0.2 mile from highway on road to Manzanita beach.

A. Shape of grains: Subangular, few subrounded

B. Count:

Total number of grains	241
Quartz grains	81
Other mineral grains identified:	
1. Plagioclase, some with inclusions	
2. Muscovite	
3. Microcline	
4. Pyribole	
5. Zircon	
6. Chalcedonic, 1 gray grain	
7. Epidote (?)	

C. Varieties of quartz grains:

1. Clear
2. Surface iron stain, citrine-colored
3. With biotite and other inclusions

D. Summary:

Quartz content	35 ± %
Chalcedonic grains	1 f

Feldspar grains are very common; lithic fragments are much less common than in samples from farther north. Citrine color of some of the quartz grains is due to iron staining.

Sample P-5041 (field sample no. 5A)

Sample taken from live dune west of highway under a telephone line that intersects the highway 2.9 miles north of junction at Florence.

A. Shape of grains: Tend to be subrounded

B. Count:

Total number of grains	222
Quartz grains	90
Other grains identified:	
1. Magnetite	
2. Plagioclase	
3. Chalcedony, 1 citrine grain	
4. Lithic fragments	

C. Varieties of quartz:

1. Aggregate grains, not uncommon
2. With negative or fluidal inclusions
3. With biotite and zircon inclusions, also tourmaline
4. With surface iron stain
5. Several with unidentified coating, possibly attached mica

D. Summary:

Quartz content	40-45%
Chalcedonic grains	1 ±

Although some of the yellowish quartz grains appear to be very slightly colored throughout, most with that color are a result of surface staining. Warrants consideration.

Sample P-5042 (field sample no. 5B)

Sample taken from tree-covered dune 2.9 miles north of Eugene - Coast Highway road junction. Right next to sample P-5041.

A. Shape of grains: Subrounded to subangular

B. Count:

Total number of grains counted 264

Quartz grains 110

Other grains identified:

1. Plagioclase

2. Microcline

3. Zircon

4. Hornblende

5. Chalcedony, 5 grains including fairly clear, brown (iron oxide), and dirty.

C. Varieties of quartz:

1. Clear

2. With negative and fluidal inclusions

3. With discontinuous surface stains of iron oxide

4. With various mineral inclusions

5. Dirty with numerous unidentified dark-colored inclusions

D. Summary:

Quartz content $45 \pm \%$

Chalcedony $2 \pm \%$

Feldspar is very common but some considerably weathered. Most light-colored or citrine grains are the result of surface stains.

Sample P-5043 (field sample no. 6)

Live dune sand just west of highway, 2.5 miles north of Lake Tahkenitch Creek.

A. Shape of grains: Tend to be subrounded

B. Count:

Total number of grains 275

Quartz grains 75

Other grains identified:

1. Plagioclase, inclusions not uncommon in some
2. Microcline
3. Chalcedony (10 grains, may be largely flint)
4. Basic lava

C. Varieties of quartz grains

1. Clear, few negative or fluidal inclusions
2. Few with mineral inclusions including tourmaline, rutile, and biotite
3. Aggregate grains
4. With brown surface stain, probably iron oxide
5. Fractured, with brown stains along or in fractures

D. Summary:

Quartz content $30 \pm \%$

Chalcedony, some with
color all the way
through $5 \pm$

Light-colored grains are mainly feldspar

Sample P-5044 (field sample no. 7)

Sample taken from dune nearest road just north of bridge over Tenmile Creek.

A. Shape of grains: Subrounded to subangular

B. Count:

Total number of grains 146

Quartz grains 59

Other grains:

1. Plagioclase, very common

2. Chalcedony - 7 grains including brown (iron oxide), fairly clear, citrine, and dirty varieties

3. Lithic, including basic lava

C. Varieties of quartz grains:

1. Clear

2. With fluidal or negative inclusions

3. Aggregate

4. With surface stain, probably iron oxide

D. Summary:

Quartz content $40 \pm \%$

Chalcedony $5 \pm$

Most light-colored or citrine quartz grains are the result of surface staining. Warrants consideration.

Sample P-5045 (field sample no. 8)

From live dune just west of railroad at Houser siding, north of Coos Bay.

A. Shape of grains: Tend to be subrounded

B. Count:

Total number of grains 248

Quartz grains 97

Other grains identified:

1. Plagioclase, very common

2. Microcline

3. Lithic, very common

C. Varieties of quartz:

1. Clear

2. Aggregate, some fairly common and some with mineral inclusions

3. With negative, fluidal and mineral inclusions

D. Summary:

Quartz content $40 \pm \%$

Citrine grains are largely the result of surface iron oxide stain.

Sample P-5046 (field sample no. 9)

Dune sand from near east abutment of Charleston Bridge

A. Shape of grains: Subangular, tending slightly toward subrounded

B. Count:

Total number of grains 199

Quartz grains 87

Other grains identified:

1. Plagioclase } - some badly weathered

2. Microcline }

3. Lithic

C. Varieties of quartz grains:

1. Clear

2. With inclusions of rutile (?)

3. Aggregate grains

4. With slight iron oxide surface stain

D. Summary:

Quartz content $45 \pm \%$

Chalcedony $3 \pm$

Some very coarse particles are present including one large grain of citrine quartz. Quartz grains seem to be a bit cleaner than those of other samples.

8-16-61

TO: HMD
FROM: RSM

SUBJECT: Sand Island

Here are two analyses of the mineral content of the black sands on Sand Island near the mouth of the Columbia River. "Heavies" only given.

Garnet	1.00 %	2.33%
Zircon	rare	rare
Magnetite	78.28	20.33
Ilmenite-		
chromite	15.80	27.53

Both samples taken at upstream end of island by Twenhofel, (GMI Bull 30) Twenhofel (op cit) also says:

"Sand Island in the Columbia River is composed entirely of sand and driftwood. The island has been made by river deposition, and it is said to have increased in area since the building of the jetties. There are very rich concentrations of black mineral particles on sand Island, particularly on the south side. The concentrations were seen in the high and upper mid tidal zones and there may be much beneath the vegetation which covers most of the island. There is a very rich concentration of black sand on the upstream side of the island on both sides of the old docks and on the south side to the trestle connecting the main or west part of the island. Concentration is very rich on the south side of the dock; less on the north side. The main part of the island has excellent concentration on the south side, very poor on the north side - the side toward the mainland of Washington. The sands of the island are everywhere filled with driftwood and this wood seems to be more abundant in places where the black sand concentration is greatest. There must be thousands of tons of magnetic black sands on Sand Island."

Robert Wilson of N.W Iron & Steel says he is interested in Sand Island but would be just as happy if not more so if Washington obtained it. He has leases all along the Columbia from the mouth to a point roughly 8 miles upstream from Megler. He also said that he was getting a big run-around from the Land Board in Salem.

Lloyd Ruff said Sand Island had a lot of piles and driftwood and probably a lot of sand at or just below low tide level. He also said that the Army would object to backfilling in the channel but would be happy to have some of the in-channel bars dredged--and pumped somewhere else.

ASTORIA SANDS
USAM

WHITE SAND
6 1/2% HEAVY MINERALS
4.16% FREE MAGNETITE
1.05% ILMENITE

87% -- 100 MESH
Hvy MIN IN THIS FRACTION

~~BLACK SAND~~

.88% PYROXENES
.05% ZIRCON

OUT ON PENINSULA
BETWEEN HONOLULU & COAST
IGNORED BLACK SAND CONCENTR

INFO - SUPPLIED BY

FRED ROSENBERG

G-1952

CONFIDENTIAL

July 22, 1966

Mr. William A. Stickney
U.S. Bureau of Mines
P.O. Box 70
Albany, Oregon

Dear Mr. Stickney:

We have discussed the matter of obtaining ten tons of black sand with the Coos County Commissioners, and they are most anxious to cooperate in any way they can. Commissioner Mahaffey felt that the best possible place to get the sample would be from the old Eagle Mine, otherwise known in recent years as the Wright property, now owned by the county.

Here is a rough sketch map of the area showing the approximate location of both the open pit and the millsite. The new coast highway passes close by the Wright pit and millsite. The east-west road leading to the millsite, where there should be sufficient stockpiled black sand, is a well gravelled and fairly wide one. The new highway has cut through the old Seven Devils Road and several other local roads so that the situation is a little bit confusing, but I am sure that your crew will have no difficulty in finding the place and obtaining a sample.

Sincerely yours,

Ralph S. Mason
Mining Engineer

RSM:lk
Encl.

Titaniferous Ores in Oregon

Titanium occurs principally in two minerals, Rutile, a titanium oxide, and ilmenite, an iron titanium oxide. Of the two rutile is the favored source since most markets require a very low iron or no iron titanium. At the present state of the art the removal of the iron from ilmenite is not economically feasible. A recently announced beneficiation technique for upgrading ilmenite to synthetic rutile has not been proven on a commercial scale.

In Oregon considerable quantities of ilmenite, plus smaller amounts of rutile are found in the "black sands" which occur along the southwestern coast. The percentages of these two minerals is very low and it is extremely doubtful that either or both of them could ever be recovered economically unless the other constituents in the black sands could also be marketed. Included in the co-products that might be recovered are chromite, magnetite, zircon, quartz, feldspar, gold and platinum.

The black sand deposits are located up to several miles inland from the beach and on a series of terraces several hundred feet above sea level. The deposits are widespread but the concentration of black sand varies widely both vertically and horizontally. Generally speaking the deposits are unconsolidated or weakly cemented. Land ownership of black sands areas includes, state, federal, county and private. Access to the more important areas between Bandon and Coos Bay is ~~excellent~~ ¹³⁷ ~~over~~ U.S. ~~state~~ hiway 101 and various county roads.