UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary

BUREAU OF MINES
R. R. Sayers, Director

War Minerals Report 253

CLAIM POINT CHROMITE DEPOSIT
KENAI PENINSULA, ALASKA

WASHINGTON: 1943

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The War Minerals Reports of the Bureau of Mines are issued by the United States Department of the Interior to give official expression to the conclusions reached on various investigations relating to domestic minerals. These reports are based upon the field work of the Bureau of Mines and upon data made available to the Department from other sources. The primary purpose of these reports is to provide essential information to the war agencies of the United States Government and to assist owners and operators of mining properties in the production of minerals vital to the prosecution of the war.

CLAIM POINT CHROMITE DEPOSIT

Kenai Peninsula, Alaska

SUMMARY

The Claim Point chromite deposits are at tidewater near the southern tip of Kenai Peninsula, Alaska. Surface sampling and core drilling completed by the Bureau of Mines in January 1942 indicate 263,000 long tons of ore containing 17.8 percent Cr_2O_3 to be available. Beneficiation tests conducted by the Bureau indicate that the ore is amenable to concentration by tabling.

Two procedures have been considered for concentrating the ore: First, construction of a hand-sorting and crushing plant at the mine to produce 25 percent Cr_2O_3 ore of minus 1-inch size to be shipped to the Alaska-Juneau mill at Juneau, Alaska, for concentration; and second, construction of a concentrator at the mine. Approximately 75,000 long tons of concentrate of marketable grade may be recovered at a cost of $51.60 a long ton delivered to the United States under the first plan, or $31.03 a long ton under the second. Capital required is $515,000 for the first plan and $590,500 for the second. Full production should be possible within 6 months after mining operations are resumed if the ore is milled at Juneau, whereas 1 year would be required to start production if a concentrator is built at the mine. Twenty-five thousand dollars is estimated to have been expended already in remodeling the

Alaska-Juneau mill for handling the ore, and saving of time and critical materials may be effected by concentrating the ore at Juneau.

The principal chromite deposits have been sampled and outlined by core drilling. Other known deposits that have been exposed and sampled are believed to be too small or low-grade to warrant further consideration. No further work by the Bureau is contemplated.

INTRODUCTION

During 1940, 657,689 tons of chromite was imported from foreign sources by the United States and only 3,000 tons of domestic ore was produced.

Foreign supplies have become increasingly hard to obtain because of the war and consequent lack of shipping facilities, and it has become necessary to increase domestic production by developing additional reserves in this country and its territories.

Congress foresaw these conditions and, in the Strategic Minerals Act, Public 117, 76th Cong., Chap. 190, 1st sess., authorized the Bureau of Mines to investigate reserves of metals (including chromium) which at that time were considered strategic.

A preliminary investigation of two known areas on Kenai Peninsula containing chromite deposits, conducted during July and August 1941 by an engineer[1] of the Bureau of Mines, was followed by a surface-sampling and core-drilling program conducted by Bureau of Mines engineers[2] to determine the quantity and grade of the ore.

The United States Geological Survey had a field party[3] in the region from July until September 1940; maps and geological data were assembled and made available to the Bureau of Mines. A Geological Survey representative[4] checked cores and interpreted structural data revealed by the drilling.

1 Robert S. Sanford, district engineer.
2 Robert S. Sanford, district engineer, and John W. Cole, associate mining engineer.
3 P. W. Guild, assistant geologist.
4 George O. Gates, associate geologist.

Location and Accessibility

Claim Point is a small peninsula about one-fourth square mile in area extending into the mouth of Port Chatham Bay from the north shore. Its general location is shown on figure 1. It is separated from the mainland by Chrome Bay, except for a grass- and tree-covered sand spit.

The nearest supply base is Seldovia, a small fishing village of about 400 population, about 25 miles by boat north of Claim Point on Cook Inlet. (See fig. 2.) The entire area under discussion is part of the Third Judicial Division of Alaska with headquarters at Valdez.

Cook Inlet is served by the Alaska Steamship Co., which has maintained once-a-month service to Seldovia since the entrance of the United States into the war. The company's basic freight rate on machinery from Seattle to Seldovia during the summer of 1942 was 41¼ cents a cubic foot, or 82½ cents a hundred pounds, whichever was greater, plus a 25-percent emergency surcharge. Rates on groceries and other supplies varied but were generally higher than those given above. Freight on bulk ore valued at $60 a short ton is $7 a short ton plus 25-percent emergency surcharge from Seldovia to Juneau or from Seldovia to Seattle, and $4.50 a short ton plus 20-percent emergency surcharge from Juneau to Seattle. Wharfage at Seattle is $0.07 a hundred pounds.

Minimum first-class passage by steamship from Seattle to Seldovia during the summer of 1942 was $111.65 plus 10 percent Federal tax. The one-way trip required about 2 weeks. Transportation may be had at slightly higher cost on the more frequent ships from Seattle to Seward, Alaska, thence by train to Anchorage, and from there to Homer or Seldovia by plane. Passengers and air express are carried by Pan American Airways from Seattle to Fairbanks and by local plane companies from Fairbanks to other parts of Alaska. Plane fare is $175 plus tax from Seattle to Fairbanks and $65 plus tax from Fairbanks to Homer. Charter plane service also is available at Anchorage.

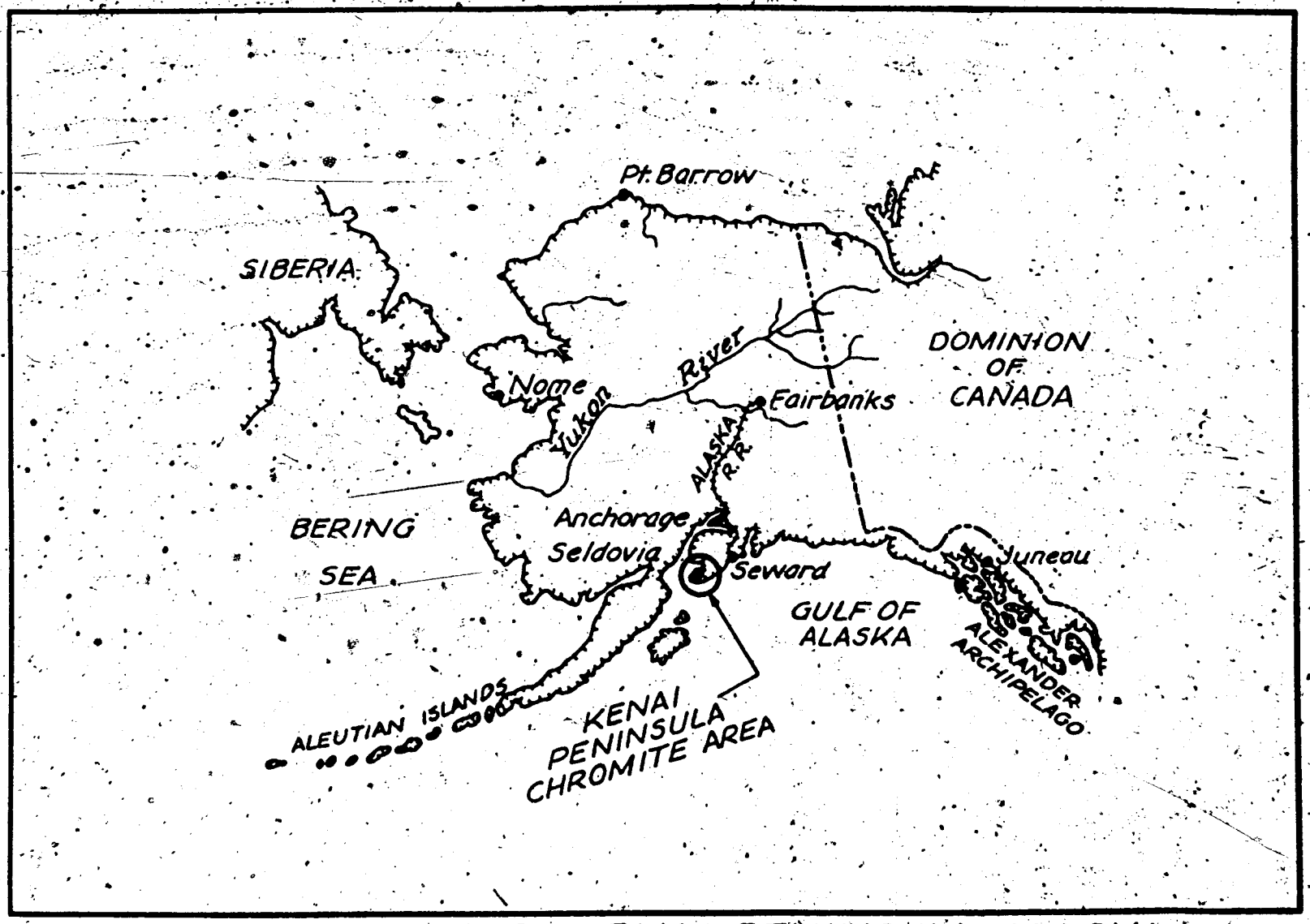
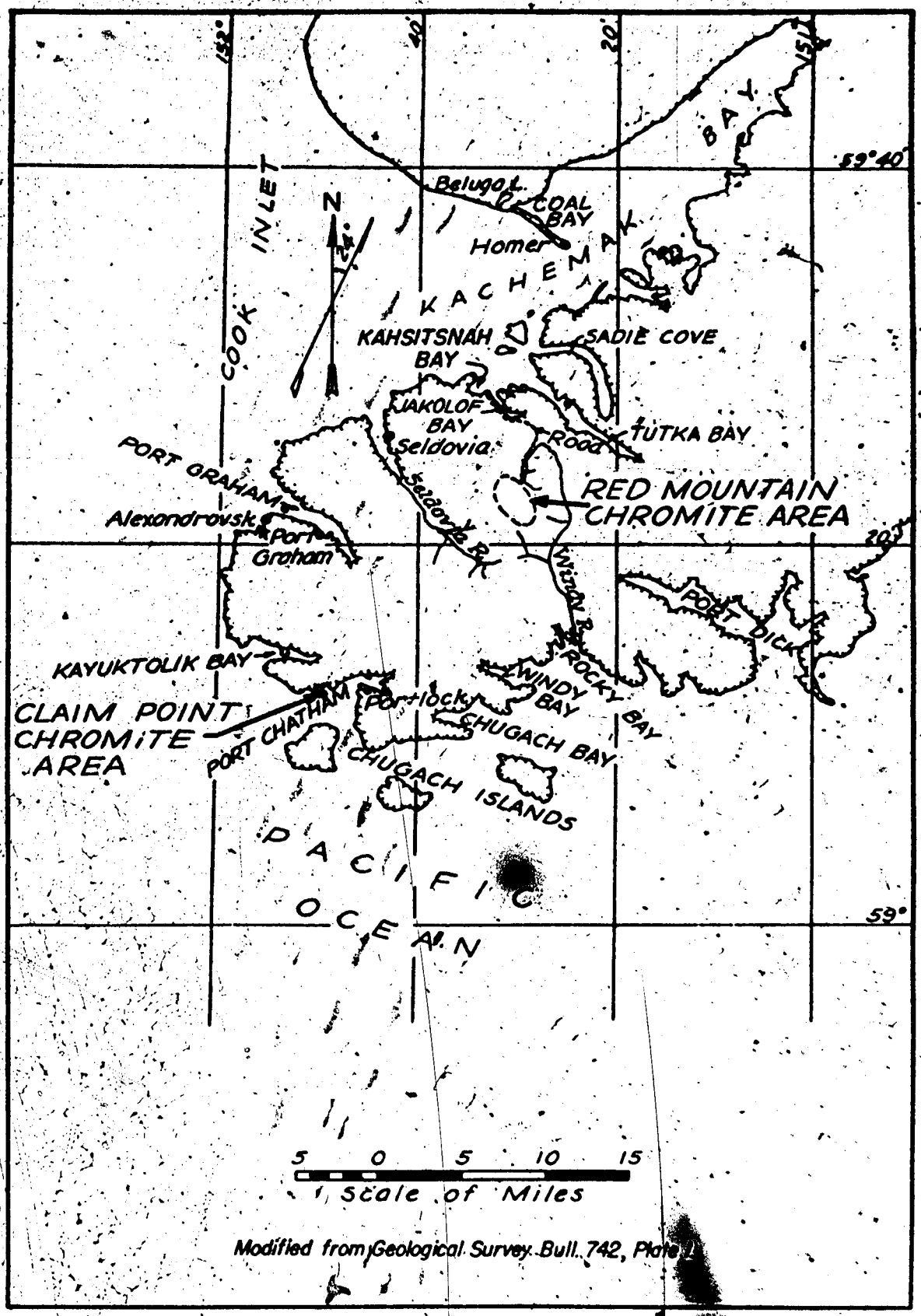


FIG. 1 - INDEX MAP, KENAI PENINSULA ALASKA



Modified from Geological Survey Bull. 742, Plate 1

FIG. 2- KENAI PENINSULA CHROMITE AREAS

Bluff No. 1 claim, which covers deposit No. 10, is the only patented property at Claim Point. To the southeast is Bluff No. 2 claim, which covers deposits Nos. 7 to 8b, inclusive. The Reef mine is covered by a claim parallel to the strike. Most of the mining property at Claim Point is held by John W. Blodgett, Jr., 900 Public Service Building, Portland, Oreg.

There is a privately owned radio station at Seldovia, which furnishes commercial telegraph service through the Alaska Communications System. Small ocean-going motorships maintain irregular freight service on Cook Inlet, but most local travel is by small gasoline-powered fishing boats. Groceries and other supplies are available at Seldovia and Homer. Standard Oil Co. maintains a bulk-oil plant at Seldovia to serve the Cook Inlet area. Fuel and lubricating oils in reasonable quantities may be obtained at prices comparing favorably with United States prices. Low-grade coal may be obtained from Homer at $10 to $12 a ton. There is a grade school and limited living facilities across Port Chatham Bay at Portlock. There is a high school and modern hospital at Seldovia.

Physical Features

Kenai Peninsula is typical of the Alaskan coastal region in vegetation and climate. Claim Point and the adjacent mainland are covered by a jungle growth of vegetation, spruce trees of logging size being fairly abundant. Although the nearest weather station at Homer, Alaska, records an annual rainfall of only 30 to 40 inches, it is believed that the precipitation at Claim Point is much more than this. Sea-level temperatures range from zero to 80°, rarely remaining below freezing for more than a few days at a time. However, above 600 feet elevation freezing weather and heavy snowfall are the rule from October to May. Tides are high on Cook Inlet, the maximum range at Seldovia being 28 feet, making it difficult to construct docking facilities that can be used at both low and high tide.

Labor and Living Conditions

Because of war conditions, labor is scarce and wages are high. The following wage rates prevail for a 40-hour week in this part of Alaska:

	Rate per hour
Skilled labor	$1.50-$2.00
Semiskilled labor	1.25- 1.50
Common labor	0.965

Time and one-half is paid for time over 40 hours a week.

Local labor is scarce during the fishing season, from June to September; consequently, during this period it must be imported from the States.

History

The earliest reference to the Claim Point chromite deposits was made by U. S. Grant.[5] A. C. Gill[6] examined them in 1918, and P. W. Guild[7] investigated them from June to September 1940.

Production has been limited to 1,000 long tons averaging 46 to 49 percent Cr_2O_3 in 1917 and 1,000 long tons averaging 40 percent Cr_2O_3 in 1918. Most of this ore came from the Reef mine. During 1918 and 1919 a stamp mill was constructed to mill the ore from deposit No. 10, but no ore was milled and operations ceased with the end of the war. The locations of the principal deposits on Claim Point are shown on figure 3.

ORE DEPOSITS

General Geology

The ore deposits are found in an intrusion of ultramafic rock that underlies all of Claim Point, Chrome Bay, and an area on the mainland extending 800 to 1,000 feet from the shore of Chrome Bay. Except for the land area on the mainland opposite Claim Point, the contact is covered by the sea, so that the size and shape of the intrusion are not known.

5 Grant, U. S., and Higgins, D. F., Preliminary Report on the Mineral Resources of the Southern Part of Kenai Peninsula. In Mineral Resources of Alaska, Report on Progress of Investigations in 1909: Geol. Survey Bull. 442, 1910, pp. 168-169.

6 Gill, A. C., Chromite of Kenai Peninsula, Alaska: Geol. Survey Bull. 742, 1922, 52 pp.

7 Guild, P. W., Chromite Deposits of Kenai Peninsula, Alaska: Geol. Survey Bull. 931-G, 1942, pp. 139-175.

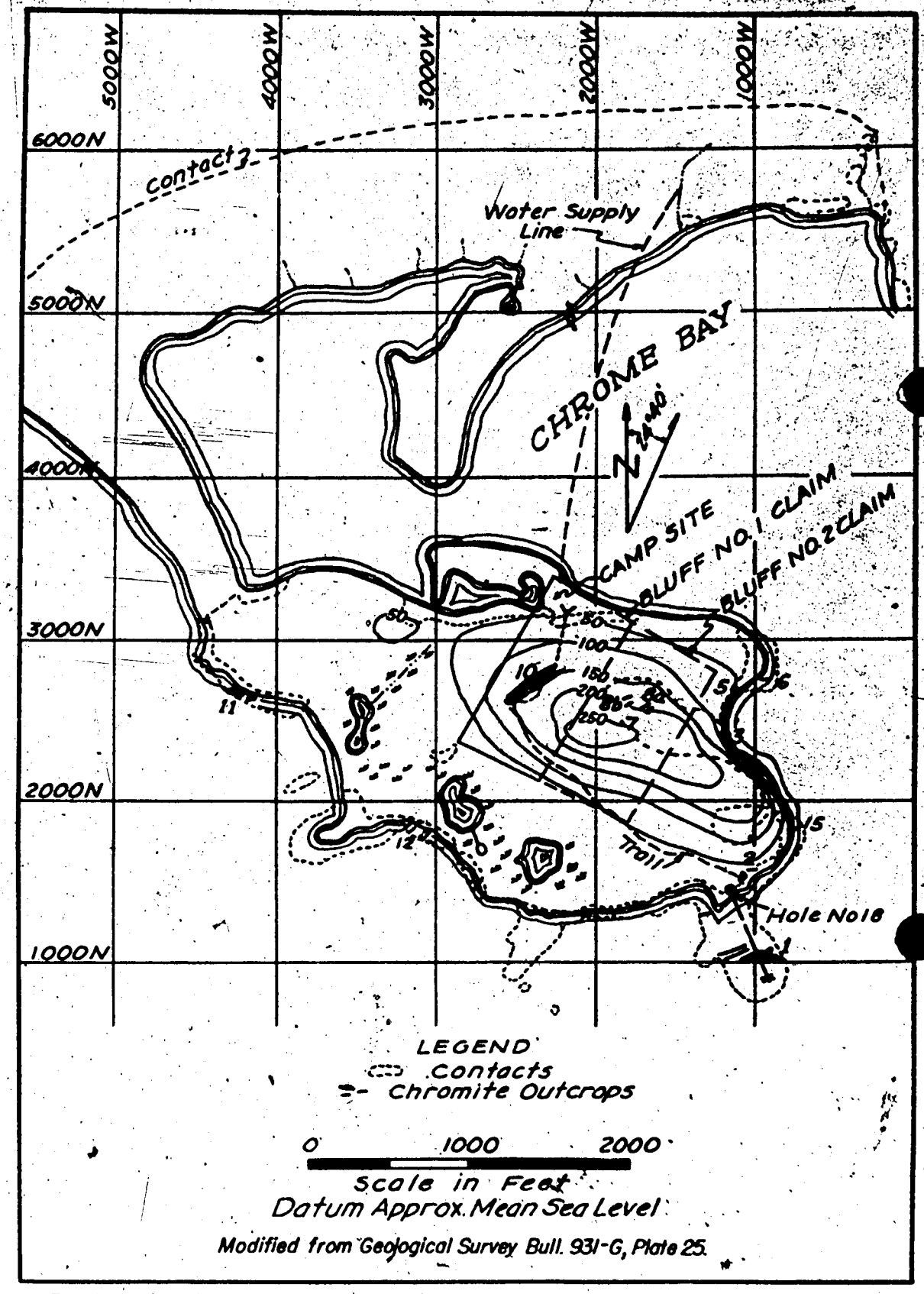


FIG.-3-GEOLOGIC & TOPOGRAPHIC MAP

According to Guild:[8]

> The surrounding rocks consist of a series of graywackes, slates, cherts, limestones, and interbedded volcanic rocks. The ultramafic rocks are discordant intrusives into the graywacke series. The predominant rock is dunite. Along the margins of the mass the dunite has been altered to serpentine. The Kenai Peninsula was strongly glaciated in Pleistocene and Recent time. The ultramafic rocks are characterized chemically by their high content of magnesium and iron, low silica and alumina, and almost complete absence of alkalies. The dunite consists almost entirely of olivine $(Mg, Fe)_2SiO_4$, with accessory chromite grains, averaging about 0.5 millimeter across, which usually constitute less than 1 percent of the rock. The chromite-bearing intrusives are tentatively assigned a late Jurassic or Cretaceous age. No ultramafic dikes are known to have been intruded into the surrounding sedimentary and metamorphic rocks. The outstanding characteristic of the intrusive bodies is the banding. Faulting and jointing are common.

These deposits were apparently formed by magmatic segregation. The mineral deposits are irregularly distributed throughout the dunite without apparent pattern, where exposed, and undoubtedly occur through the unexposed volume of the dunite in about the same proportion. The total volume of ore is so small, compared to the volume of the dunite, that discovery of buried ore bodies by present known methods is both uncertain and expensive.

Mineralogy

According to Guild:

> Chromite is a black, opaque mineral with a submetallic luster, belonging to the spinel group of the isometric class. It is distinguished from magnetite by its brown streak and low degree of magnetism. Its theoretical chemical composition is FeO, Cr_2O_3, with 32 percent FeO and 68 percent Cr_2O_3, but in fact it always contains MgO, Fe_2O_3, and Al_2O_3. Its formula, therefore, is usually written as $(Fe, Mg)O \cdot (Cr, Al, Fe)_2O_3$. The percentage of Cr_2O_3 in the mineral may thus range between wide limits, but with few exceptions its range in the deposits under discussion is small and the percentage of Cr_2O_3 near 58.

The chromium-iron ratio of concentrate from this ore is expected to vary from 2.5 to 2.8 to 1. The 45-percent concentrate of a sample of ore from deposit No. 10 was found to have a chromium:iron ratio of 2.71:1.

The dunite is composed principally of olivine containing approximately 40 percent magnesium oxide and 6 percent iron.

8 Guild, P. W., U. S. Geological Survey Bulletin 931-G, abstracted by author.

Similar rock has been found to have desirable qualities for manufacturing refractories,[9] and investigations are said to be in progress to recover magnesium metal from olivine.

Recent analyses of products obtained by the Bureau of Mines in mill tests on a sample of chromium ore from deposit No. 10 show the presence of appreciable quantities of nickel in the ore. Analyses of the products showed them to contain 0.2 to 0.5 percent nickel. The nickel appears to occur in the olivine as a silicate. Further field investigation will be necessary to find if the nickel occurs in commercial quantities in any part of the intrusion. New Caledonia nickel occurs in the silicate mineral, garnierite, which is found as incrustations and fracture filling in serpentine. Garnierite is a soft green mineral distinguishable from serpentine by a very slight difference in color. Serpentinized contact zones would seem to offer the best possibility of containing garnierite in commercial quantities. New Caledonia ore is said to average 5 to 6 percent nickel.

Nickel was also noted in the samples from the nearby Red Mountain deposits which are described in a separate War Minerals Report on that area. Further investigations will be proposed at Red Mountain during the 1943 working season, and the possibility of developing commercial quantities of nickel in connection with the chromium in the Kenai Peninsula deposits will be fully investigated at that time.

Description

Deposit No. 1 or Reef Mine

A deposit of banded chromite outcrops about 400 feet south of Claim Point on a reef connected to the mainland at low tide. The main part of the ore body consists of two parallel lenticular bands in contact with each other at one point. Each band is more than 100 feet long and approximately 25 feet in maximum width. A hole drilled from the mainland to intersect the ore zone at 150

9. U. S. Department of Commerce, Bureau of Standards, Research Paper 645, Bureau of Standards Journal of Research, vol. 12, Feb. 1934.

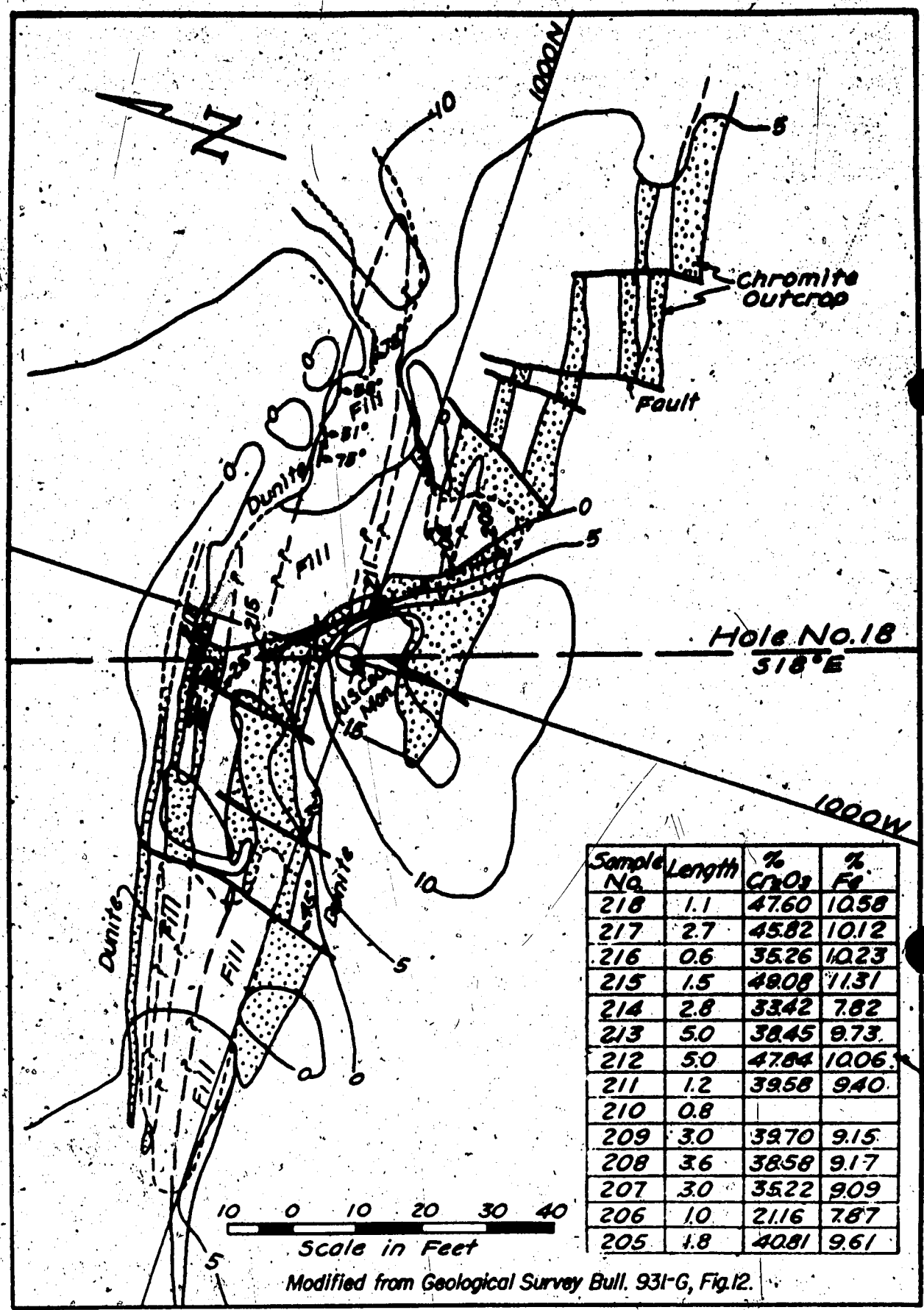
feet under the widest part of the ore body proved that direct shipping ore does not extend to that depth. The best zone intersected was 2 feet of 34.24 percent Cr_2O_3. The ore body may rake to one side or the other of the hole, or there may be enough ore between the hole and the outcrop to be worth further investigation. A geologic plan of the deposit is shown on figure 4, and an assay section through the drill hole exploring the deposit is shown on figure 5.

Deposit No. 10

On the north slope of Claim Point, adjacent to Chrome Bay, is the largest known body of low-grade chromite on Kenai Peninsula. Trenching and drilling indicate that it consists of two irregular but generally parallel lenses of banded chromite in contact with each other at their midpoint at the outcrop elevation, striking northeast and dipping vertically. The outcrop elevation is approximately 140 feet. The ore body feathers out to the southwest. The lenses apparently rake to the northeast, as they do not outcrop above the drill holes on the north end. Geological data revealed by the outcrop and drilling suggest that the body is terminated at the north end between drill holes and the exposed bluff. Drilling indicates that the ore body is at least 350 feet long and has a maximum width of 80 feet where the two lenses are in contact at the surface. The width and grade of the ore body appear to decrease with depth. An assay plan of the No. 10 deposit is shown on figures 6, 6A, and 6B. Sections through drill holes on the No. 10 deposit and analyses of samples obtained in drilling are shown on figures 7, 8, 9, 10 and 11.

Deposits Nos. 7, 8a, 8b(S), and 8b(N)

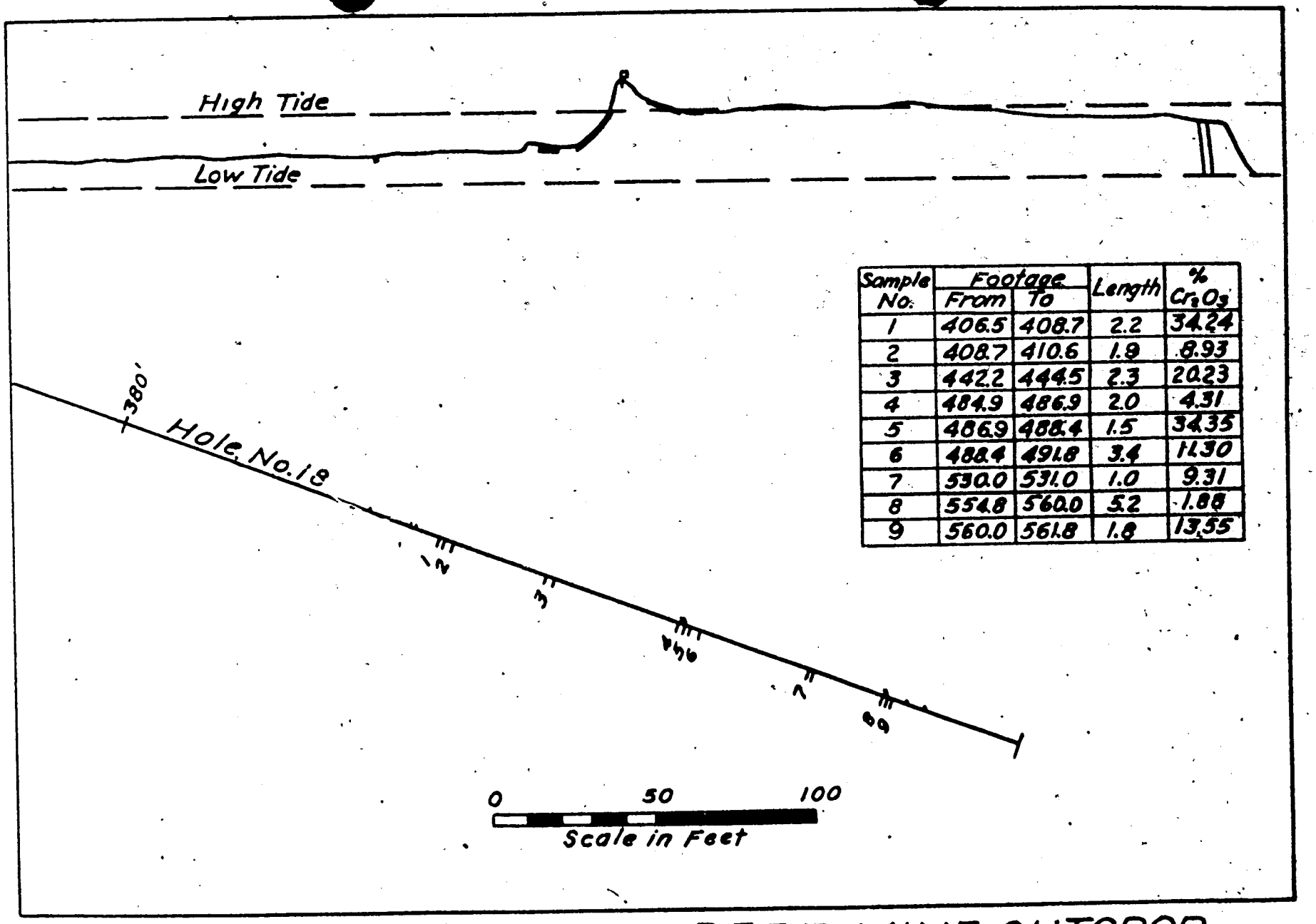
To the northeast of deposit No. 10, at a slightly higher elevation, are four deposits of low-grade banded chromite that are thought to be faulted segments of deposit No. 10. They strike northeast and dip steeply to the south. Drilling indicates that these deposits do not continue far in depth.



Sample No.	Length	% Cr_2O_3	% Fe
218	1.1	47.60	10.58
217	2.7	45.82	10.12
216	0.6	35.26	10.23
215	1.5	48.08	11.31
214	2.8	33.42	7.82
213	5.0	38.45	9.73
212	5.0	47.84	10.06
211	1.2	39.58	9.40
210	0.8		
209	3.0	39.70	9.15
208	3.6	38.58	9.17
207	3.0	35.22	9.09
206	1.0	21.16	7.87
205	1.8	40.81	9.61

Modified from Geological Survey Bull. 931-G, Fig.12.

FIG.-4- PLAN OF REEF MINE OUTCROP



Sample No.	Footage From	Footage To	Length	% Cr_2O_3
1	406.5	408.7	2.2	34.24
2	408.7	410.6	1.9	8.93
3	442.2	444.5	2.3	20.23
4	484.9	486.9	2.0	4.31
5	486.9	488.4	1.5	34.35
6	488.4	491.8	3.4	11.30
7	530.0	531.0	1.0	9.31
8	554.8	560.0	5.2	1.88
9	560.0	561.8	1.8	13.55

FIG.-5-ASSAY SECTION, REEF MINE OUTCROP

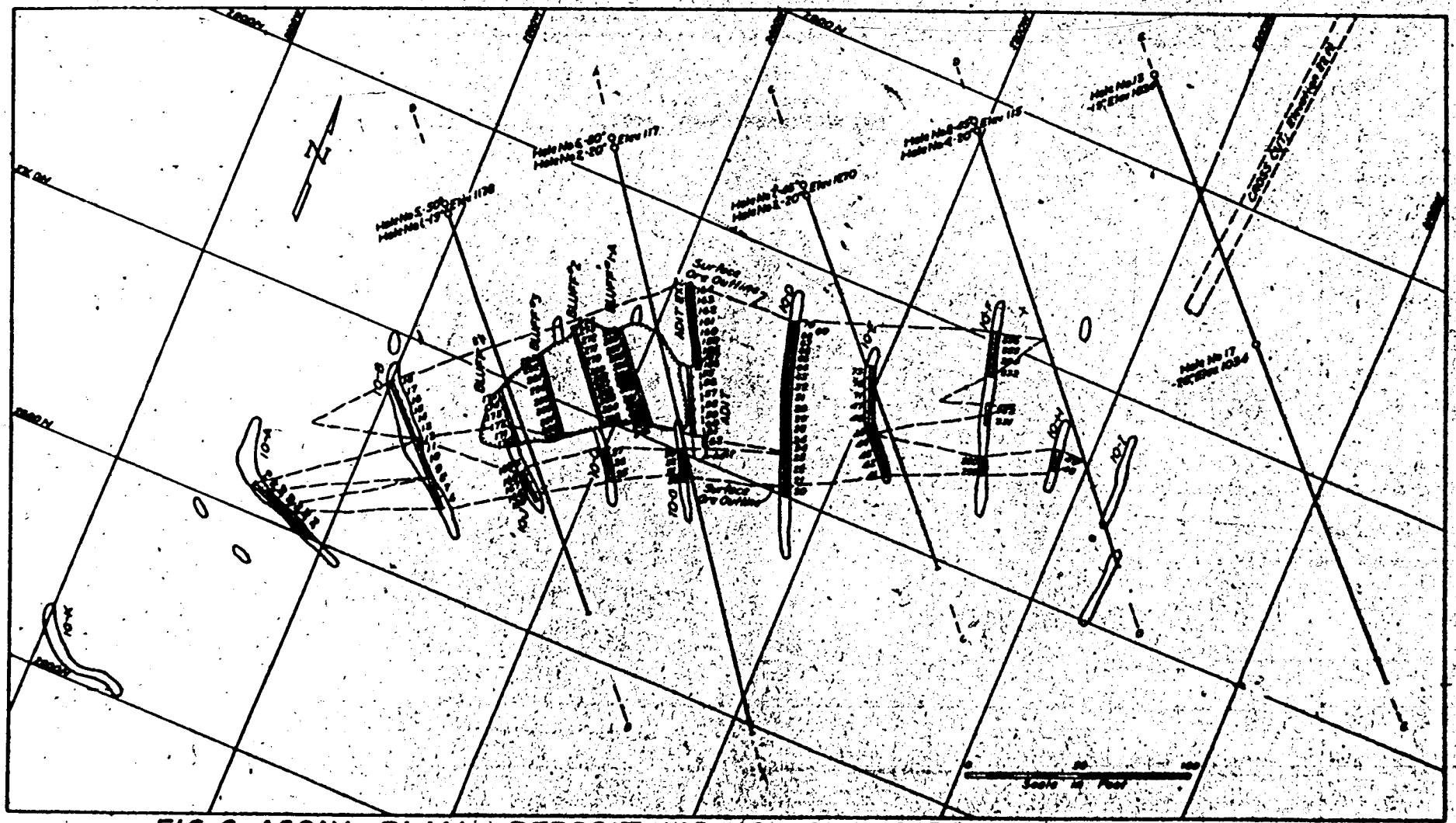


FIG. 6 ASSAY PLAN - DEPOSIT NO. 10 - CLAIM POINT, ALASKA

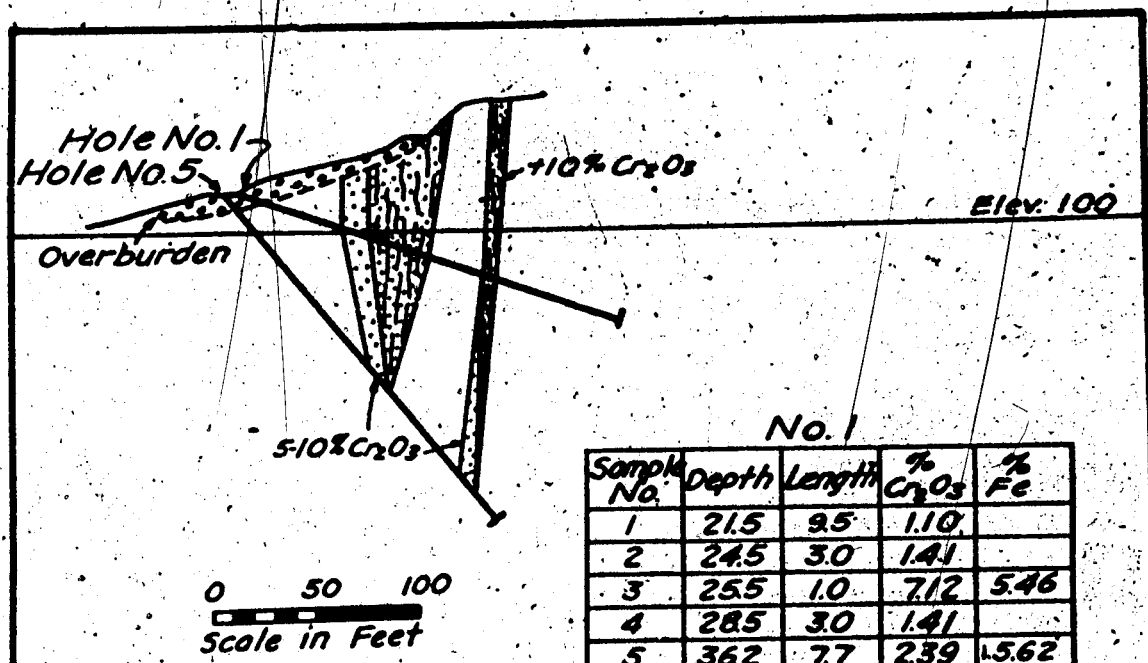
Trench No.	Sample No.	Length Feet	Cr_2O_3	Fe
10-A	19	4.5	14.92	6.90
	37	5.0	1.20	
	38	"	0.94	
	33	"	11.83	6.18
	34	"	6.17	6.39
	35	"	8.34	6.23
	36	"	0.92	
10-B	18	"	20.58	7.54
	17	"	20.96	7.72
	16	"	21.19	7.31
	15	"	22.86	7.68
	14	"	20.30	7.60
	13	"	16.70	7.12
	12	"	29.71	7.77
	11	"	37.62	8.84
	10	"	34.18	7.89
	9	"	28.10	7.82
	8	4.5	31.07	7.81
	7	5.0	16.24	6.92
	6	5.5	28.21	8.46
BLUFF #4	175	5.0	26.70	
	174	"	20.91	
	173	"	13.36	
	172	"	37.24	
	171	"	3.97	
	170	"	4.21	
10-J	169	1.5	11.62	6.38
	168	2.0	7.47	5.50
	167	4.0	9.27	
	166	5.0	13.71	6.24
	165	4.0	1.11	
BLUFF #3	293	1.5	29.63	7.44
	292	5.0	25.58	7.15
	291	"	29.10	7.86
	290	"	28.74	7.23
	289	"	20.68	6.52
	288	"	23.98	7.03
	287	"	22.66	7.08
	286	2.5	30.54	7.82
	285	4.0	50.66	10.60
BLUFF #2	274	1.8	26.18	
	273	3.2	23.70	
	272	5.0	18.64	
	271	"	15.48	
	270	"	40.80	8.29

Trench No.	Sample No.	Length Feet	Cr_2O_3	Fe
BLUFF #2	269	5.0	41.42	8.17
	268	2.2	49.40	9.03
	267	4.7	32.00	7.50
	266	2.1	20.50	6.17
	265	4.2	12.06	5.16
	264	5.0	28.96	7.40
	263	4.0	45.46	9.21
10-C	27	5.0	12.58	6.52
	26	"	15.72	6.48
	25	"	23.88	7.38
BLUFF #1A	259	1.7	14.60	6.20
	258	5.0	20.63	6.85
	257	4.0	26.04	7.21
	256	"	28.53	7.74
	255	3.5	38.79	8.36
	254	5.0	26.73	7.43
	253	1.0	8.90	3.63
	252	5.0	16.36	6.68
	251	"	12.05	7.93
	250	2.7	22.07	7.10
	249	2.9	36.03	8.38
	248	"	12.80	6.04
	247	2.5	41.96	8.95
	246	1.0	21.83	
10-G	53	3.5	10.85	6.09
	52	4.0	21.96	6.68
	51	4.2	12.59	6.34
	50	3.3	1.72	6.23
ADIT	55	5.0	39.62	8.02
	56	"	29.80	7.37
	57	"	36.18	7.37
	58	"	27.86	7.28
	59	"	24.23	8.29
	60	"	11.42	5.75
	61	1.5	3.56	5.30
	62	5.0	8.60	5.87
ADIT EXT.	164	"	14.76	
	163	"	12.91	
	162	"	13.00	6.88
	161	"	17.03	
	160	"	20.90	6.94
	159	3.0	8.16	
	158	4.3	24.02	7.61
	157	1.0	26.90	
	156	5.0	24.06	7.42

FIG.-6a- ASSAY DATA, DEPOSIT NO. 10

Trench No.	Sample No.	Length Feet	Cr_2O_3	Fe
10-D	70	4.0	12.36	5.65
	69	1.5	13.42	5.42
	68	4.5	15.38	6.74
	67	"	6.66	3.96
	66	3.0	12.68	5.49
	65	4.0	16.28	5.74
	64	5.0	13.94	5.65
	63	4.7	12.08	6.03
	32	5.0	25.58	7.56
	31	"	36.78	8.81
	30	"	33.24	7.58
	29	"	27.87	7.78
	28	5.3	30.14	8.10
	24	5.0	35.18	8.58
	54	3.0	12.82	5.71
	23	5.0	23.88	6.92
	22	"	23.88	7.12
	21	"	21.32	6.97
	20	"	8.58	5.30
10-E	73	"	20.90	5.59
	72	"	29.74	6.85
	71	"	16.96	5.74
	47	"	21.34	6.74
	46	"	14.36	6.12
	45	"	22.40	6.92
	44	"	9.94	6.09
	43	"	28.20	7.18
	42	"	19.96	6.83
	41	"	21.70	6.68
10-F	236	"	39.28	12.65
	235	"	27.22	10.12
	234	"	24.37	11.49
	233	"	24.98	11.13
	232	"	28.87	10.33
	231	"	6.24	8.30
	230	"	19.88	7.77
	229	2.0	37.96	8.60
10-H	49	5.0	15.22	6.26
	48	"	20.17	7.00

FIG.-6b- ASSAY DATA, DEPOSIT NO. 10



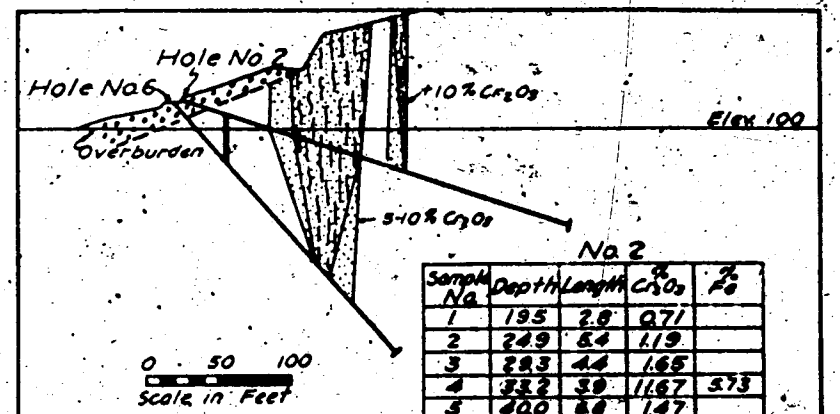
No. 1

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	21.5	9.5	1.10	
2	24.5	3.0	1.41	
3	25.5	1.0	7.12	5.46
4	28.5	3.0	1.41	
5	36.2	7.7	2.39	5.62
6	38.5	2.3	12.41	
7	44.8	6.3	1.45	
8	51.0	6.2	1.10	
9	55.8	4.8	6.51	
10	60.8	5.0	8.76	
11	62.8	2.0	8.09	
12	66.8	4.0	1.55	
13	70.8	4.0	14.48	
14	75.8	5.0	11.42	
15	80.8	5.0	12.68	
16	85.3	4.5	12.66	5.77
17	90.4	5.1	16.49	
18	94.9	4.5	14.35	
19	97.8	2.9	11.46	
20	102.9	5.1	2.97	
21	107.9	5.0	1.54	7.85
22	117.4	9.5	1.76	
23	125.0	7.6	1.50	
24	127.0	2.0	35.90	
25	129.7	2.7	5.77	
26	143.6	13.9	1.70	
27	153.3	9.7	1.08	
28	163.3	10.0	0.77	
29	172.0	8.7	0.89	
30	182.5	10.5	1.08	
31	189.8	7.3	0.86	
32	202.0	12.2	0.70	6.48

No. 5

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	19.0	11.3	0.80	
2	29.0	10.0	1.01	
3	37.0	8.0	0.66	
4	46.7	9.7	1.66	
5	57.0	10.3	0.33	
6	64.7	7.7	0.77	
7	74.0	9.3	1.08	
8	85.0	11.0	0.85	
9	94.9	9.9	0.75	
10	104.0	9.1	0.78	7.36
11	112.0	10.0	0.74	
12	114.0	2.0	6.34	
13	125.0	11.0	4.84	
14	135.8	10.8	1.85	
15	147.4	11.6	2.80	
16	157.4	10.0	1.07	
17	167.4	10.0	0.68	
18	176.0	8.6	3.68	
19	181.1	5.1	9.85	
20	189.8	8.7	7.61	
21	200.4	10.6		
22	211.5	11.1	1.08	7.50

FIG.-7- SECTION B-B, DEPOSIT NO. 10



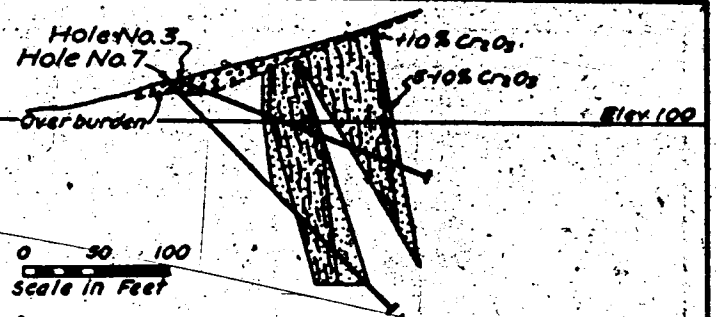
No. 2

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	195	2.8	0.71	
2	249	5.4	1.19	
3	283	4.4	1.65	
4	332	3.9	11.67	5.73
5	400	6.8	1.47	
6	503	10.3	0.95	
7	568	6.5	3.22	
8	593	2.5	7.26	
9	635	4.2	2.23	
10	698	6.3	7.50	
11	712	1.4	8.50	
12	803	9.1	3.61	5.18
13	903	10.0	10.00	
14	1003	10.0	20.00	7.00
15	1100	9.7	24.68	
16	1150	5.0	17.00	
17	1200	"	25.25	
18	1260	"	16.16	
19	1329	7.9	1.58	
20	1431	11.2	1.01	
21	1485	5.4	8.71	
22	1569	8.4	6.02	
23	1675	10.4	1.10	
24	1752	7.8	1.24	7.33
25	1813	6.1	1.23	
26	1866	5.3	12.45	
27	1974	10.8	0.72	5.75
28	2074	10.0	0.05	
29	2178	10.4	0.84	
30	2288	11.0	0.92	
31	2390	10.2	0.88	
32	2495	10.5	1.10	
33	2581	10.8	0.89	
34	2685	10.4	1.80	7.95
35	2760	10.5	0.65	5.79
36	2864	10.4	0.89	

No. 6

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	260	9.8	1.01	
2	350	9.0	1.05	
3	450	10.0	1.02	
4	526	7.6	5.24	
5	572	4.8	11.42	
6	627	5.5	2.04	
7	719	9.2	1.18	
8	772	5.3	3.68	
9	874	10.2	3.64	
10	974	10.3	2.10	
11	1084	10.9	1.08	
12	1200	11.6	1.02	
13	1300	10.0	2.70	5.94
14	1411	11.1	0.92	
15	1475	6.4	1.73	
16	1534	5.9	19.30	
17	1583	4.9	24.68	
18	1642	5.9	10.11	
19	1700	5.8	3.32	
20	1765	6.5	6.40	
21	1812	4.7	6.90	
22	1844	3.2	4.55	
23	1830	8.6	1.34	
24	2031	10.1	1.17	
25	2131	12.0	1.56	
26	2231	8.0	0.78	
27	2332	10.1	1.11	

FIG.-8- SECTION A-A, DEPOSIT NO. 10



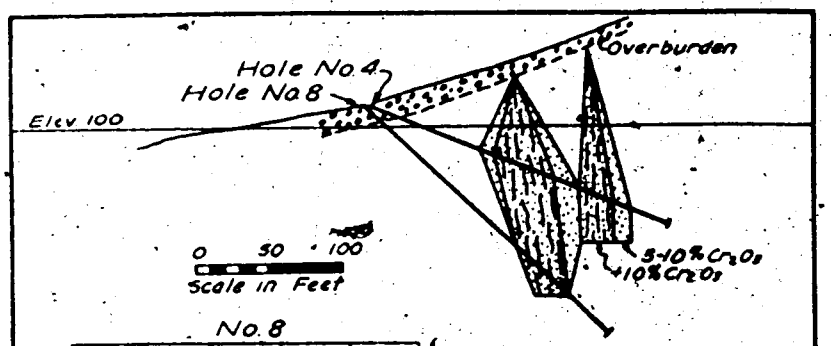
No. 7

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	21.0	10.0	2.54	
2	31.4	10.4	3.01	
3	39.5	8.1	2.83	
4	46.0	6.7	1.47	
5	46.2	1.2	9.64	5.48
6	50.8	4.6	9.30	
7	62.3	11.5	2.43	
8	72.0	9.7	0.84	
9	77.[illegible]	5.5	4.32	
10	88.0	11.5	1.49	
11	99.6	10.6	4.65	
12	104.8	5.2	10.83	
13	112.9	8.1	2.85	
14	123.0	10.1	4.71	
15	128.0	5.0	12.32	6.97
16	133.0	"	12.16	
17	138.0	"	13.62	
18	143.0	"	19.03	
19	148.0	"	22.93	
20	153.0	"	13.65	
21	158.0	"	20.73	
22	163.0	"	21.17	
23	170.3	7.3	5.88	
24	175.5	5.2	6.82	
25	180.5	5.0	8.40	6.08
26	188.5	8.0	8.39	
27	191.8	2.3	28.44	9.90
28	195.8	4.0	5.00	
29	205.8	10.0	1.65	
30	215.8	10.0	1.17	
31	221.0	5.2	0.92	

No. 3

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	32.8	10.0	1.31	
2	38.2	5.4	8.50	5.40
3	43.7	5.5		
4	53.7	10.0	2.16	6.52
5	62.3	8.6	1.67	
6	67.4	5.1	9.45	
7	72.0	4.6	12.04	
8	76.8	4.8	17.54	
9	82.0	5.2	18.00	
10	86.5	4.5	14.77	5.76
11	91.6	5.0	9.63	
12	94.8	3.3	24.52	
13	99.8	5.0	15.14	
14	105.0	5.2	11.60	7.09
15	116.4	11.4	4.70	
16	126.7	10.3	2.94	
17	131.8	5.1	14.97	
18	136.8	5.0	15.83	
19	141.8	"	32.27	
20	146.8	"	34.25	
21	152.7	5.9	20.75	
22	157.7	5.0	13.28	
23	164.0	6.3	5.76	5.41
24	171.8	7.8	5.84	6.00
25	182.2	10.4	2.92	
26	187.4	5.2	1.58	

FIG.-9- SECTION C-C, DEPOSIT NO. 10



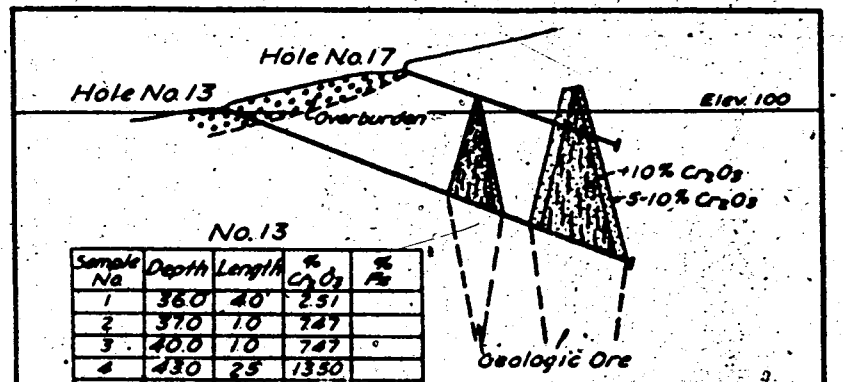
No. 8

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	280	12.7	0.86	
2	380	10.0	0.79	
3	477	9.7	0.65	
4	585	10.8	0.80	
5	685	10.0	0.85	
6	785	10.0	1.20	
7	802	1.7		
8	903	10.1	1.00	8.12
9	1003	10.0	1.82	
10	1106	10.3	1.10	
11	1206	10.0	1.63	
12	1306	10.0	1.32	
13	1406	10.0	1.50	
14	1473	6.7	1.01	
15	1553	8.0	12.13	7.62
16	1575	2.2	8.28	8.55
17	1620	4.5	8.75	6.91
18	1644	2.4	18.68	7.36
19	1678	2.7	10.92	8.39
20	1730	5.2	16.35	10.22
21	1764	3.4	10.58	8.31
22	1814	5.0	11.96	7.29
23	1848	3.4	7.78	6.76
24	1894	4.6	16.74	7.70
25	1944	5.0	16.13	7.81
26	1970	2.6	27.40	8.98
27	1994	5.0	[illegible]	7.53
28	2085	9.1	0.65	
29	2135	5.0	1.50	
30	2185	5.0	1.82	
31	2280	9.5	1.13	

No. 4

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	32.6	10.8	0.76	
2	45.6	13.0	0.91	
3	58.0	12.4	0.86	
4	59.0	1.0	2.26	
5	61.5	2.5	9.79	6.35
6	69.3	7.8	2.26	
7	79.3	10.0	1.30	
8	89.3	10.0	5.66	
9	95.0	5.7	12.74	7.75
10	101.8	6.8	10.96	6.50
11	107.7	5.9	11.63	6.76
12	112.8	5.1	12.63	6.49
13	117.8	5.0	22.40	7.16
14	122.8	5.0	24.48	7.40
15	126.0	3.2	23.89	8.60
16	134.2	8.2	17.54	
17	145.1	10.9	8.82	
18	154.5	9.4	4.48	
19	163.8	8.9	12.48	11.41
20	168.4	5.0	17.53	6.98
21	173.4	5.0	22.61	8.40
22	178.4	5.0	22.62	8.07
23	180.8	2.4	21.15	9.40
24	183.6	2.8	3.76	7.60
25	194.0	10.4	7.43	7.63
26	203.0	9.	2.11	
27	208.0	5.0	1.83	
28	218.0	10.0	1.94	

FIG. 10. SECTION D-D. DEPOSIT NO. 10



No. 13

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	36.0	4.0	2.51	
2	37.0	1.0	7.47	
3	40.0	1.0	7.47	
4	43.0	2.5	13.50	
5	49.9	6.9	4.06	
6	57.4	8.5	1.34	
7	67.3	9.9	1.83	
8	77.6	8.3	1.36	
9	87.9	10.3	5.29	
10	136.0	48.1	1.26	
11	138.0	2.0	13.70	
12	148.0	10.0	2.12	
13	153.3	5.3	2.22	
14	161.8	8.5	1.76	
15	165.6	3.8	2.20	
16	168.0	2.4	14.40	
17	170.6	2.6	14.40	
18	180.6	10.0	7.08	
19	185.6	5.0	16.28	6.96
20	190.6	5.0	16.05	6.62
21	195.4	4.8	14.93	6.88
22	200.5	5.1	13.86	7.48
23	204.9	4.4	7.87	
24	214.9	10.0	1.99	
25	221.9	7.0	0.80	
26	233.3	11.4	6.47	
27	243.0	9.7	15.30	7.43
28	248.5	5.5	14.98	
29	255.9	7.9	18.90	
30	259.0	3.1	18.16	
31	264.0	5.0	24.80	7.62
32	274.0	10.0	7.30	6.00
33	279.0	5.0	22.05	7.22
34	289.3	10.3	13.31	
35	299.3	10.0	7.62	
36	309.3	10.0	1.90	

No. 17

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	24.5	10.0	0.70	
2	34.5	10.	0.87	
3	44.7	10.2	0.84	
4	52.3	10.0	2.08	
5	54.7	2.4	14.16	6.96
6	64.8	10.1	2.09	
7	74.8	10.0	1.58	
8	84.8	10.0	1.35	
9	95.0	10.2	1.31	
10	105.0	10.0	1.29	
11	111.0	6.0	2.08	
12	113.5	2.5	10.86	6.68
13	117.6	4.1	2.36	6.87
14	118.5	0.9	8.12	5.86
15	123.5	5.0	11.13	6.80
16	124.3	0.8	9.21	6.16
17	126.7	2.4	24.61	7.77
18	128.5	1.8	18.85	6.60
19	133.5	5.0	18.78	7.27
20	138.0	5.5	6.96	6.46
21	149.2	10.2	4.43	
22	158.1	8.9	4.24	

No Sample taken 37.0'-39.0' & 40.0'-40.5'

FIG. 11. SECTION E-E. DEPOSIT NO. 10

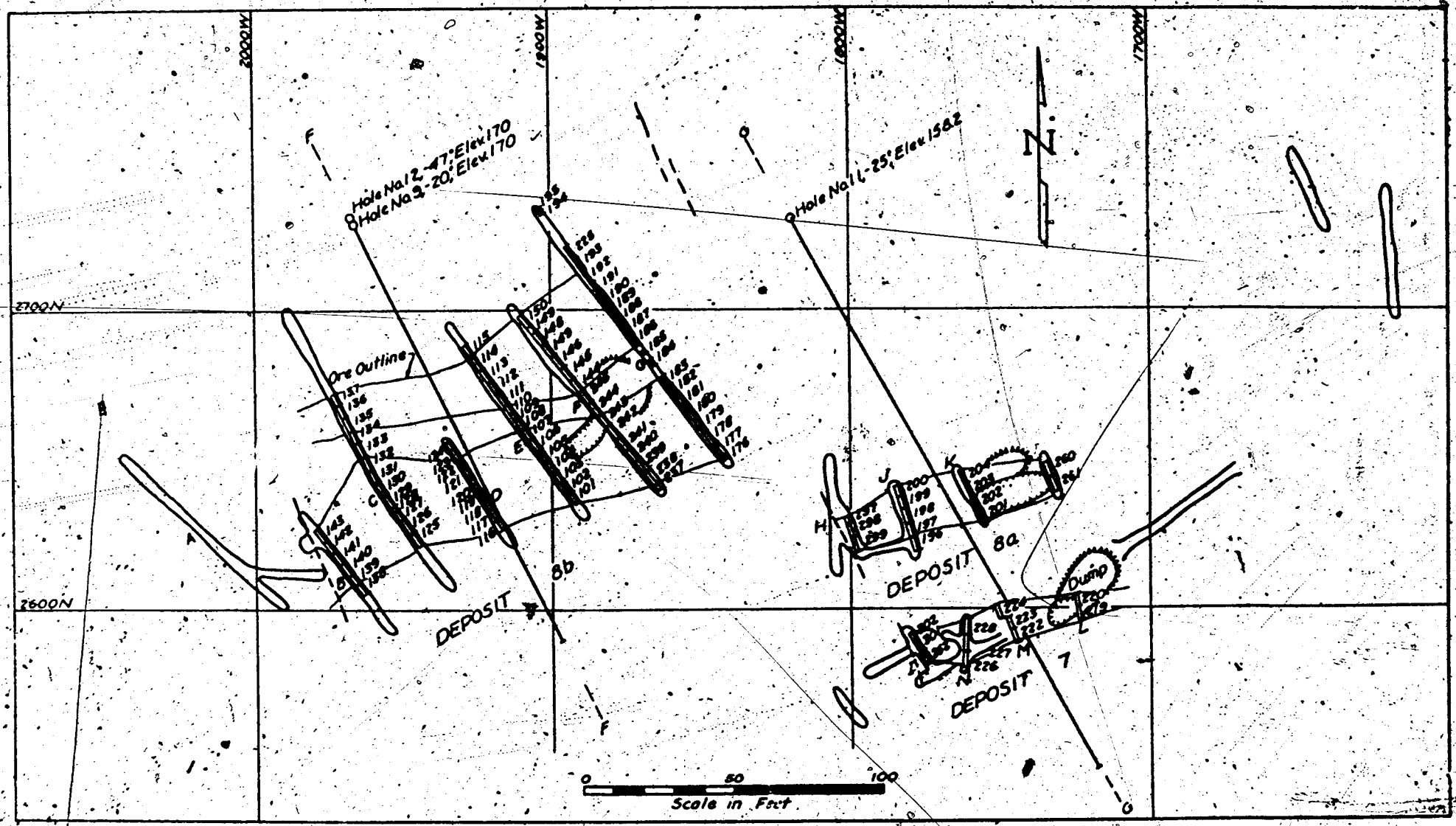


FIG. 12 ASSAY PLAN, DEPOSIT NO's 7, 8a, & 8b

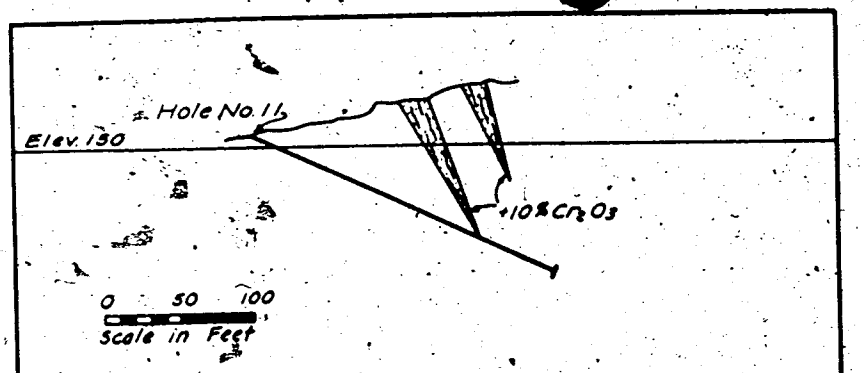
Trench No.	Sample No.	Length Ft.	Cr_2O_3	Fe
	297	2.8	17.42	-
H	298	5.0	20.42	
"	299	"	17.34	
	200	3.0	6.49	5.68
	199	5.0	19.19	6.75
J	198	"	10.32	
	197	"	5.11	
	196	"	13.33	
	302	2.7	30.05	
I	301	5.0	35.04	
	262	"	17.36	
	228	"	34.68	7.95
N	227	"	26.85	
	226	"	24.04	7.21
	224	"	23.20	7.00
M	223	"	36.72	8.09
	222	"	16.18	6.49
	220	"	28.28	7.32
L	219	"	21.92	6.81
	204	5.5	8.41	
	203	5.0	20.05	
K	202	"	21.07	
	201	"	19.71	
	260	"	15.43	
	261	"	18.92	

FIG.-12a- ASSAY DATA, DEPOSITS 7 & 8a

Trench No.	Sample No.	Length Ft.	Cr_2O_3	Fe
	143	5.0	3436	7.42
	142	"	3083	7.43
	141	"	1104	6.26
B	140	"	2959	7.07
	139	3.5	1018	5.99
	138	5.0	147	
	137	4.0	800	6.44
	136	5.0	1394	6.97
	135	"	1340	7.15
	134	"	539	7.16
	133	"	702	7.09
	132	"	1488	7.42
C	131	"	1790	7.74
	130	"	1265	5.36
	129	"	2344	8.19
	128	1.0	2878	8.17
	127	5.0	885	6.71
	126	"	2992	7.93
	125	"	1580	7.11
	124	3.0	172	
	123	5.0	484	6.42
	122	3.0	1256	6.61
	121	4.5	1441	7.10
D	120	5.0	2241	6.38
	119	2.5	4693	9.50
	118	4.5	3055	7.15
	117	5.0	3765	7.56
	116	4.0	1897	6.12
	115	5.0	243	5.02
	114	6.0	1867	5.97
	113	5.0	1329	5.56
	112	"	1376	5.39
	111	"	1633	6.39
	110	3.5	136	4.83
E	109	3.0	872	5.87
	108	4.0	221	
	107	5.0	2430	5.85
	106	"	2329	6.00
	105	"	1896	6.12
	104	4.0	2028	7.06
	103	"	1506	6.65

Trench No.	Sample No.	Length Ft.	Cr_2O_3	Fe
E	102	4.0	2894	7.65
	101	"	3244	8.12
	150	8.0	135	4.88
	149	2.5	300	5.89
	148	"	1742	7.08
	147	"	1729	5.68
	146	"	1354	6.51
	145	"	2547	6.62
	144	"	1445	6.48
F	245	"	1359	
	244	"	357	
	243	"	1216	
	242	"	1902	
	241	"	2036	
	240	"	2920	
	239	"	3228	
	238	"	1228	
	237	2.5	700	8.05
	196	2.2	1012	6.34
	194	0.8	300	5.83
	225	5.0	293	5.69
	193	"	475	5.65
	192	"	1040	5.59
	191	"	1291	6.71
	190	"	1458	6.01
	189	2.4	1733	7.23
	188	4.0	1150	
	187	5.0	1254	
G	186	"	11.8	
	185	1.5	1182	7.29
	184	2.8	848	
	183	5.0	1047	
	182	"	968	
	181	"	1473	6.06
	180	"	2187	
	179	"	3030	7.37
	178	"	2871	10.28
	177	"	1868	
	176	1.5	1822	7.14

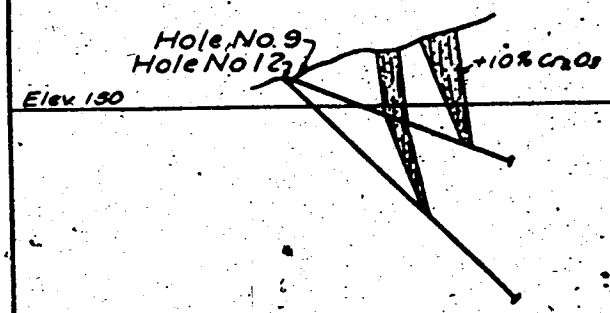
FIG-12b- ASSAY DATA, DEPOSIT NO's 7 & 8a



Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	5.0	5.0	1.94	
2	18.7	9.7	1.09	
3	24.0	5.3	0.84	
4	44.0	10.0	0.74	
5	53.6	0.6	13.00	7.50
6	64.5	10.2	1.97	
7	75.0	10.5	1.80	
8	85.5	10.5	2.05	
9	95.5	10.0	1.64	
10	106.0	10.5	0.71	
11	116.0	10.0	0.92	
12	126.0	10.0	0.78	
13	132.2	0.3	11.14	9.60
14	145.9	10.4	0.73	
15	155.8	9.9	0.99	
16	165.8	10.0	0.78	
17	170.5	4.2	10.37	6.49
18	174.1	1.8	12.81	6.60
19	181.0	5.0	1.14	
20	191.0	10.0	1.04	
21	200.0	9.1	1.27	
22	209.2	9.2	1.22	
23	218.9	9.7	1.14	
24	224.0	5.1	1.32	

No samples taken, 24.0-34.0; 44.0-53.0; 53.6-54.3; 126.0-131.0, 132.2-138.5, 165.8-166.3, 170.5-172.3, 174.1-176.0.

FIG. 13 - SECTION G-G, DEPOSIT NOS 7 & 8a



0 50 100
Scale in Feet

No 12

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	7.2	7.2	3.38	
2	16.0	8.8	1.02	
3	26.1	10.1	1.24	
4	34.5	1.5	11.32	
5	36.0	1.5	6.67	6.97
6	43.5	1.2	9.88	6.34
7	51.1	6.9	1.37	
8	60.7	9.6	1.74	
9	68.3	7.9	1.39	
10	71.3	3.0	16.47	7.48
11	82.5	3.3	9.05	6.43
12	92.7	5.2	4.54	5.95
13	108.2	11.7	0.84	
14	118.2	10.0	1.47	
15	128.2	10.0	0.59	
16	133.2	5.0	16.75	6.81
17	138.2	5.0	8.53	6.20
18	148.2	10.0	2.15	
19	158.2	"	1.11	
20	168.2	"	0.90	
21	178.2	"	1.08	
22	188.2	"	0.96	
23	198.2	"	1.06	
24	210.2	12.0	1.00	
25	220.5	10.0	1.15	

No 9

Sample No.	Depth	Length	% Cr_2O_3	% Fe
1	15.2	2.1	3.74	
2	17.1	1.9	8.97	
3	27.9	2.6	4.99	
4	50.3	10.0	1.28	
5	60.2	9.9	3.16	
6	70.2	3.2	11.90	
7	75.2	5.0	14.21	
8	80.2	5.0	13.79	
9	81.9	1.7	17.27	7.29
10	85.2	3.3	6.28	
11	90.2	5.0	6.72	
12	95.2	5.0	6.75	
13	105.3	10.1	3.72	
14	115.5	10.2	.77	
15	123.6	3.1	19.49	7.38
16	128.4	4.8	16.76	8.09
17	133.4	5.0	4.89	
18	138.4	5.0	2.18	
19	147.4	9.0	1.88	
20	152.5	12.1	1.67	
21	164.5	5.0	2.19	

No. Samples taken -
37.5-42.3
43.5-44.2
82.5-87.5
92.7-96.5
17.1-38.3
57.8-60.3
60.2-67.0
115.5-120.5

FIG. 14 - SECTION F-F DEPOSIT NO. 8b

Deposit No. 7 is 60 feet long and averages 13.2 feet in width; No. 8a is 70 feet long and averages 14.5 feet in width; No. 8b(N) is 110 feet long and averages 21.5 feet in width; and No. 8b(S) is 140 feet long and averages 31.4 feet in width. The assay plan of these deposits is shown on figure 12 and assay data on figures 12A and 12B. Sections through drill holes and analyses of samples obtained from drilling are shown on figures 13 and 14.

Sampling and Assaying

Six-inch by one-inch samples were cut at varying intervals along the outcrops, depending on the apparent continuity of the ore body and the excavation work required to expose it, and the core drill holes were planned to intersect the ore bodies at 80-foot intervals along the strike and 60- to 75-foot intervals in depth. Drill cuttings were collected in a 2-compartment sheet-metal collecting tank. When carefully collected, assays of cuttings averaged about 1 percent less than corresponding core samples, probably because of sliming and loss of chromite in overflow. Core and cuttings samples were split before being sent for analysis, half of them being held at the project until the assays were received. Core and cuttings assays were combined by the use of the E. J. Longyear tables[10] to arrive at the final grade of the ore. All analyses were made at the Reno, Nev., station of the Bureau of Mines.

Reserves

For the purpose of calculating the tonnage in deposit No. 10, 40-foot extensions of the ore body beyond the end sections have been assumed. Deposits Nos. 7, 8a, 8b(N), 8b(S) are assumed to taper from their outcrop to the points where they are intersected by the core-drill holes. A tonnage factor of 9.7 cubic feet per long ton was used. The following table summarizes the ore reserves at various mining "cut-offs."

10 Jackson, C. F., and Knaebel, J. B., Sampling and Estimation of Ore Deposits: Bureau of Mines Bull. 356, 1932, 155 pp.

Ore reserves, long tons

Deposit	Cut-off percentages of Cr_2O_3				Percent Cr_2O_3 in ore
	5	10	15	20	
10	332,840	-	-	-	14.38
	-	231,250	-	-	17.74
	-	-	160,800	-	20.15
	-	-	-	82,670	23.11
7	820	820	820	820	26.64
8a	2,790	2,790	2,790		16.51
8b(N)	13,060	13,060			15.02
8b(S)	15,100	15,100	15,100	15,100	21.14
	364,610				14.72
		263,020			17.81
			179,510		20.21
				98,590	22.84

Calculations in this report are based upon ore above 10 percent, or 263,000 long tons of 17.8-percent Cr_2O_3 ore. It should be possible to raise the grade of the shipping product to 25 percent Cr_2O_3 by discarding 94,000 long tons of 5-percent waste in sorting operations, leaving 169,000 long tons to be shipped for milling.

A few hundred tons of shipping-grade ore might be recovered by hand sorting, but in general the ore is disseminated in low-grade bands that carry 5 to 35 percent Cr_2O_3.

Additional possible ore below the deepest holes is estimated to be 50,000 long tons of 13-percent Cr_2O_3. There remains 500 long tons of 40-percent ore and possibly 2,000 long tons of milling ore above low tide in deposit No. 1 that might be recovered without resorting to submarine mining.

Value of Product

According to Metals Reserve schedules dated May 25, 1942, the concentrate resulting from treatment of the sample of ore from deposit No. 10 meets the specifications for high-grade ore. The base price for high-grade chromite ore delivered in the United States is $40.50 a long ton for ore containing more than 45 percent Cr_2O_3 with a chromium:iron ratio higher than 2.5:1. A bonus of $0.90 a ton for each percent over 45 of Cr_2O_3 and of $1.50 a

ton for each 0.1 above 2.5 to 1 chromium:iron rati is being paid. The value of the concentrate is indicated to be $43.50 per long ton delivered to the United States.

Development

A 40-foot crosscut has been driven through deposit No. 10 at the 140-foot elevation. During the past year, 1942, a 290-foot crosscut driven from the site of the old mill intersected deposit No. 10 at the 25-foot elevation. Some timber was required through a faulted section about 100 feet from the portal, but indications are that the rock will be comparatively easy to mine.

Equipment

A considerable part of the equipment that will be needed to mine, crush, sort, and ship the ore was purchased and transported to Claim Point by Red Mountain Chromite, Inc., before operation was discontinued.

Camp buildings include a 100- by 30-foot steel bunkhouse partitioned into 12 sleeping rooms, a kitchen, and a dining room, three family dwellings, a bath house, and a laboratory. All are new and in good condition.

Equipment includes gasoline and Diesel-driven compressors and generators, conveying equipment, cone crusher, rock drills, and accessories, a small sawmill, laboratory, and timber for crushing plant and dock. The only major pieces of equipment known to be lacking for operation is a jaw crusher for primary breaking and a power shovel.

An ample supply of water is delivered to the camp site by gravity from a stream on the north shore of Chrome Bay through a 2,000-foot, 3-inch, inverted siphon.

PRESENT AND PROPOSED OPERATIONS

Preparatory operations were begun by the owners in December 1941.

Plans were made to crush the ore at the mine to minus 1-inch size. It was expected that hand sorting would recover a small amount of high-grade ore and remove a considerable quantity of waste. The ore was then to be shipped to the Alaska-Juneau gold mill at Juneau for concentration.

A section of the Alaska-Juneau mill was remodeled to handle the ore. Conveyors have been constructed from the wharf to a stock-pile site and thence to a feed bin above the ball mills.

The owners ceased mining operations in July 1942. Subsequent activity has consisted of a visit to the property in November 1942 by engineers of the Alaska-Juneau Gold Mining Co. to inventory and appraise equipment and material at the mine. Negotiations are in progress for the operation of the property by the Alaska-Juneau Co. for the United States Government on a fee basis.

Two attempts were made by the owner to recover the high-grade ore from the Reef mine in January 1942 and again in June 1942. Hourly labor was used, and it is thought that the cost of mining was too high for profitable operation. The ore had to be cobbed from the waste, and the work could be carried on only at low tide. Approximately 100 tons of ore was mined and stock-piled on the beach. It might be possible to contract mining the remainder of the ore if other ore is produced from Claim Point as planned.

PROPOSALS

Private operation of the property is a commercially hazardous venture because of the uncertainty of the shipping situation, the large initial investment required, and the uncertain market for chromium ore. If the need for chromium is critical, the proper Government agency should accelerate negotiations toward operation

of the property on a fee basis; or a special contract guaranteeing present prices for chromium ore for a length of time estimated to be sufficient to allow the operators' return of their investment should be negotiated with the owners or other prospective operators.

Although it should be possible to produce hydro-electric power from several streams along the shores of Port Chatham Bay within 4 miles of the mine, the scope of planned operation will not justify installation of a hydro-electric plant. Diesel units will furnish the most economical power.

Results of tests conducted by the Salt Lake City station of the Bureau of Mines on a sample of ore from deposit No. 10, Claim Point, indicate that the ore is amenable to table concentration. A concentrate meeting Metals Reserve specifications for high-grade ore was produced from a feed containing 28.2 percent Cr_2O_3, 89 percent of the Cr_2O_3 content being recovered in a product containing 45 percent Cr_2O_3 and 11 percent silica and having a chromium: iron ratio of 2.7:1. The ore was ground to minus 48-mesh, separated by screening into four products ranging in size down to minus 200-mesh, and tabled. The table middling and tailing were then reground to minus 200-mesh and retabled. The slime was recovered by settling and was mixed with a portion of the table middling and the table concentrate to yield the final product. Flotation tests were unsuccessful. Magnetic separation tests on the ore indicate that this method might be used, but the procedure was more complicated and results were not as favorable as those obtained by tabling. Fine grinding and sizing of the finely ground pulp will be the chief milling problems.

It is assumed that, regardless of the grade of the feed, the mill tailing will contain 7 percent Cr_2O_3 according to the best procedure found by laboratory tests.

A possible flow sheet for the crushing and hand-sorting plant is shown in figure 15. A flow sheet for milling based on the beneficiation tests conducted by the Bureau of Mines is indicated in figure 16.

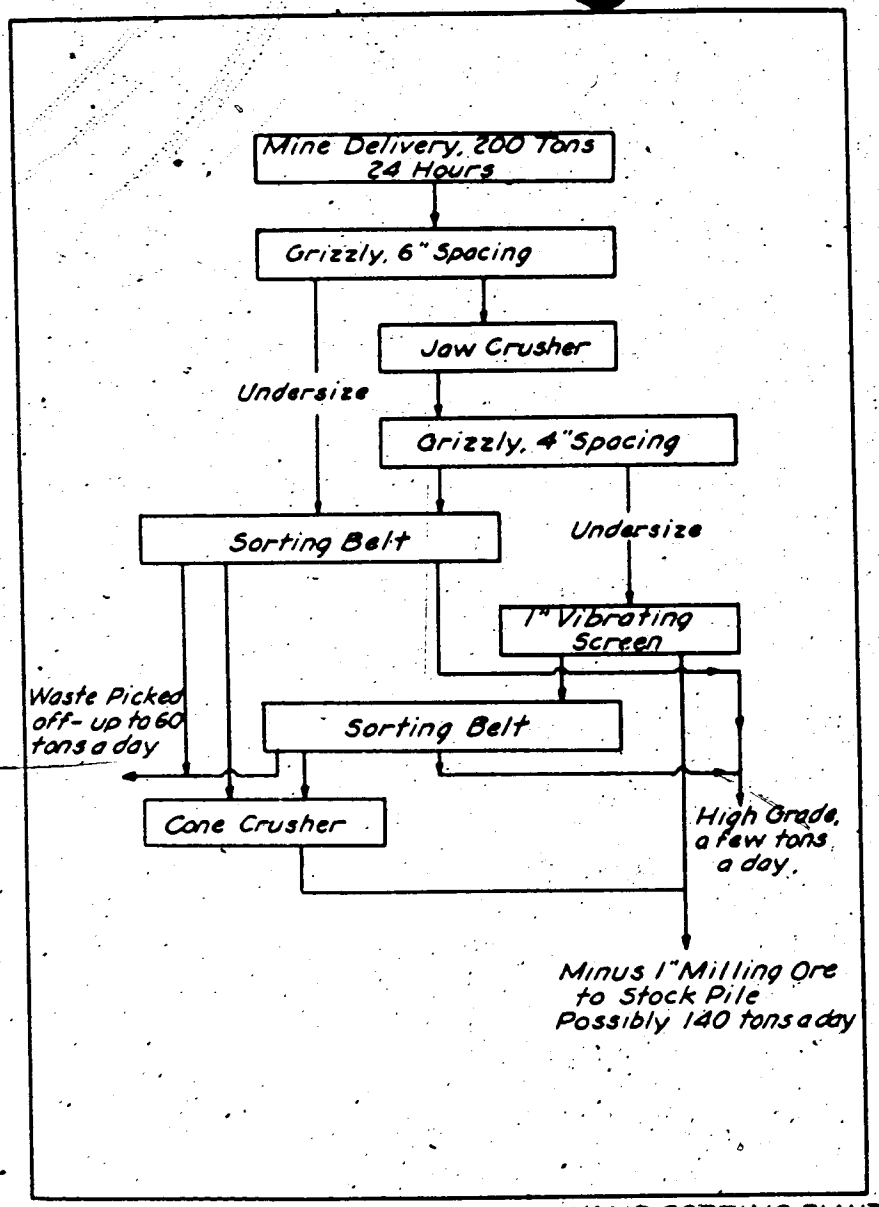


FIG. 15- SUGGESTED CRUSHING & HAND SORTING PLANT FLOW SHEET

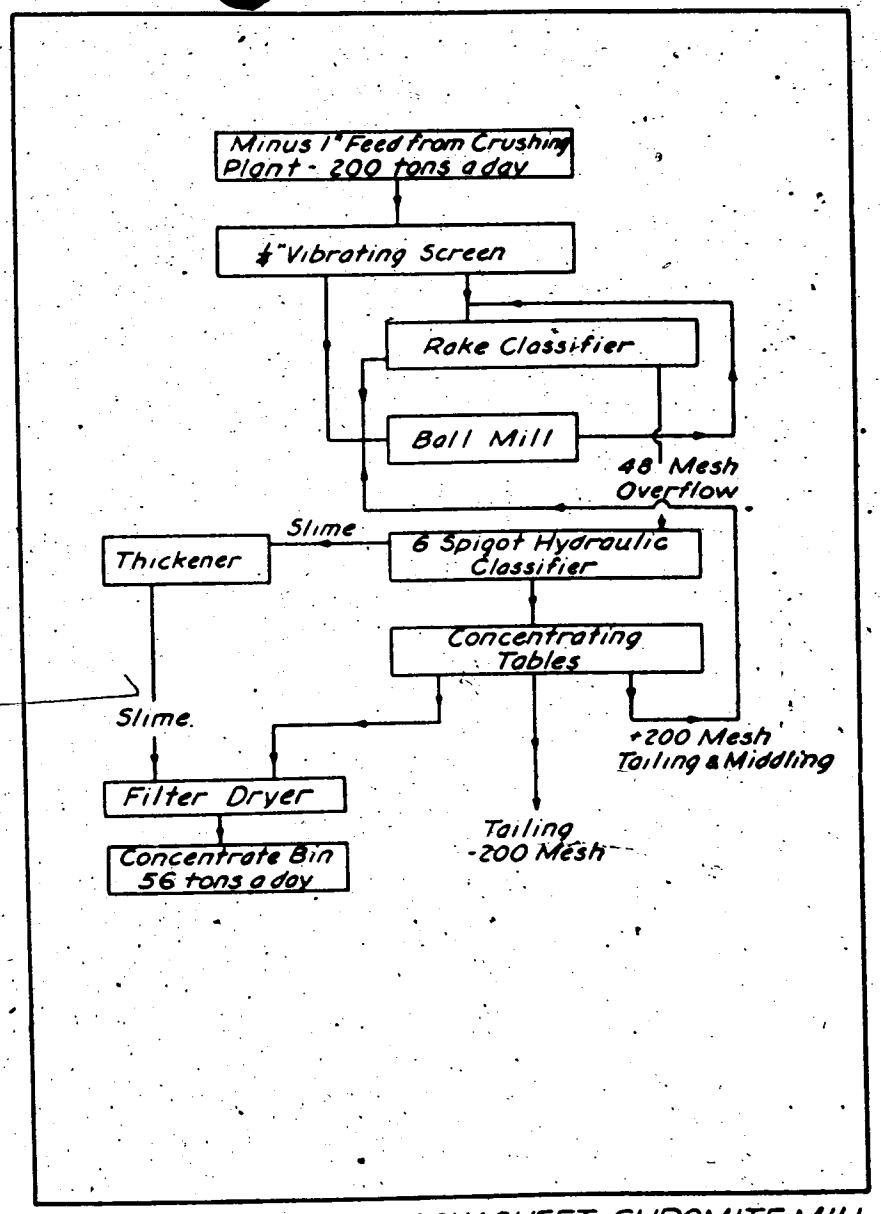


FIG. 16- SUGGESTED FLOW SHEET, CHROMITE MILL

ESTIMATES

Transportation

The chief problem in operating the property, if the Alaska-Juneau mill should be used, is transportation of the ore from the mine to the mill. If 200 long tons of ore a day are mined, the indicated life of the property is 4 years. This rate of production will amount to 4,500 long tons a month to be shipped for concentration. The water distance to be traveled is 700 miles, or an average of 4 days each way for the usual freighter. This time probably would be doubled by convoy traveling. Thus, it is estimated that minimum shipping space required will be equivalent to full-time service of a 3,000-ton ship. Shipping is all under rigid control of the United States Government, and a high priority will be needed to obtain shipping space. Present commercial freight rates charged by the Alaska Steamship Co. on bulk ore amount to $9.80 a long ton from Seldovia to Juneau and $7.62 a long ton for freight and Seattle wharfage from Juneau to Seattle. The rate from Seldovia to Seattle is the same as the rate from Seldovia to Juneau, plus $1.57 a long ton for Seattle wharfage.

Mining

If all the indicated ore at Claim Point is mined by open-cut methods, assuming the hard dunite will stand on a 60° slope, 600,000 long tons of waste, including entry ways, will have to be broken and removed to recover 263,000 long tons of ore, an ultimate ratio of waste to ore of 2.3:1. To supply 200 long tons of ore a day, an average of 520 long tons of rock will have to be mined. Cost of removing waste will be the same as cost of mining the ore. Similar open-cut mines are the Orogrande-Frisco mine in Idaho, which produced 500 to 600 tons of gold ore a day during 1937 at a direct mining cost of 10 cents a short ton, and the Weepah mine at Tonopah, Nev., which produced 42,711 short tons of gold ore during the last half of 1936 at a cost of 18.7 cents a short ton,[11] an average

11 Gardner, E. D., and Mosier, McHenry, Open-cut Metal Mining: Bureau of Mines Bull. 433, 1941, pp. 160-161.

for the two properties of approximately 15 cents a short ton. Labor, which accounted for half of the cost, will be doubled in Alaska, making the estimated cost 25 cents a long ton. Increased cost of material and supplies plus freight will raise the direct mining cost to 28 cents a long ton of waste and ore. As the ultimate ratio of waste to ore will be 2.3:1, the total mining cost of the ore will be 92 cents a long ton.

If all the ore is mined by underground methods, 100,000 long tons may be recovered from a glory hole at an estimated mining cost of $0.75 a long ton; 135,000 long tons above the crosscut level may be recovered from shrinkage stopes at an estimated mining cost of $2.50 a long ton; and 28,000 long tons below the crosscut level may be recovered at an estimated mining cost of $6 a long ton; an over-all average mining cost of $2.21 a long ton is indicated.

Milling

It is estimated that 94,000 long tons of waste containing 5 percent Cr_2O_3 can be eliminated from the total tonnage by hand sorting, leaving 169,000 long tons of ore containing 25 percent Cr_2O_3 to be milled. Metallurgical investigations indicate that 74,000 to 80,000 long tons of concentrate containing 45 percent Cr_2O_3 may be recovered; 75,000 long tons recovery will be assumed for calculating purposes. Crushing and hand sorting is estimated to cost $1 a long ton of material removed or $0.35 a long ton of mined ore. Ore-handling and milling is estimated to cost $1.50 a long ton at the Alaska-Juneau mill, or the same amount for milling is estimated if the ore is concentrated at the mine.

Wharf Operation

Loading ore or concentrate into ships by the use of conveyors is estimated to cost $0.10 a long ton.

Capital Expenditures

As different items included under capital expenditures are in various stages of completion, the following estimates are made

without regard to the amounts that have actually been expended: Housing is estimated to have cost $50,000; completed cost of the crushing and hand-sorting installation is estimated at $75,000; completed cost of the dock and ore-loading facilities is estimated at $100,000; investment in mining machinery is estimated at $72,000; and surface plant, including shop, power plant, and fuel storage is estimated at $100,000. Cost of ore-handling equipment at Juneau and remodeling of the Alaska-Juneau mill is estimated at $25,000; construction of a 200-ton concentrator with a ball mill, classifiers, and concentrating tables is estimated to cost $100,000. Operating capital required will be $150,000.

The following equipment is necessary to operate the property if the ore is shipped to Juneau for concentration, disregarding the equipment which the owners already have on the property.

Mining equipment	Approximate Seattle prices
Open cut:	
1 Diesel power shovel, 3/4-cubic yard, with crane boom and clamshell bucket as extra equipment for handling crushed ore	$15,000
3 Gasoline trucks, 5-ton	4,500
1 Tractor with blade	7,500
1 Diesel compressor, 450-cubic foot	6,500
1 Gasoline compressor, 125-cubic foot	1,000
1 Wagon drill	1,600
3 Jackhammers, 60-pound, complete with hose, steel, etc.	1,500
	37,600
Underground:	
1 Diesel compressor, 450-cubic foot	4,500
3 Drifters, complete with hose, steel, bits, etc.	2,100
6 Stopers, complete with hose, steel, bits, etc.	3,600
1 Loading machine, small	3,500
1 Battery locomotive, 3-ton, complete with two battery units, charger, etc.	10,000
10 Mine cars, 3/4-cubic yard, Granby-type	5,000
	28,700
Freight	5,700
	72,000

Surface plant:

Shop:

Bit-grinding machine Forge Threading and shanking machine Acetylene welding outfit Arc welder Miscellaneous	$20,000

Power plant:

1 Diesel generator, 200-hp.	3,500
1 Diesel generator, 100-hp.	2,500

Fuel oil and gasoline storage:

2 Tanks, 10,000-gallon	5,000
Freight and installation	12,500
	43,500

Crushing plant:

1 Bin, crude-ore, 200-ton	1,000
1 Jaw crusher, 24- by 30-inch	15,000
1 Drive motor, 50-hp.	1,000
1 Symons cone crusher, 2-foot	5,000
1 Drive motor, 30-hp.	700
2 Sorting belts, 30-foot	2,000
2 Motor drives, 5-hp.	1,000
1 Vibrating screen	1,000
1 Belt conveyor to stockpile, 100-foot	3,000
1 Motor drive, 20-hp.	500
Freight, construction materials, and installation	44,800
	75,000

Dock and ore-loading facilities:

1 Belt conveyor, 300-foot	10,000
1 Motor and drive, 50-hp.	1,000
1 Supply boat, second-hand, 75-foot	12,000
1 Scow, wooden, 50-ton	2,000
Freight, construction materials, and installation	75,000
	100,000
Camp	50,000
	340,000

If a mill were constructed at the mine, the only change in the above equipment would be the addition of a 400-hp. Diesel generator and one 10,000-gallon fuel-oil tank for storage. The cost of these items is included in the cost of the mill. Mill equipment required would be:

1 Ball mill with feeder
1 Rake classifier
1 Hydraulic classifier
10 Concentrating tables
1 Concentrate dryer
1 Concentrate bin, 2,000-ton

Cost of completed 200-ton mill at $500 a ton of daily capacity is $100,000.

A sawmill will be necessary and will be charged against the cost of material. Cost of track, ties, pipe, etc., is included in the cost of mining.

Capital Required

First case (if the ore is shipped to Juneau for concentration):

Complete plant at the mine	$340,500
Alteration of Alaska-Juneau mill	25,000
Operating capital	150,000
	515,500
Less operating capital	150,000
	365,500
Salvage	25,000
	340,500
Amortization:	
On each long ton of ore mined	$1.29
Interest (for 2 years at 4 percent ($40,280) for each long ton of ore)	.15
	1.44

Second case (if the ore is concentrated at the mine):

Complete plant at the mine (excepting concentrator)	$340,500
Concentrator	100,000
Operating capital	150,000
	590,500
Less operating capital	150,000
	440,500
Salvage	25,000
	415,500
Amortization:	
On each long ton of ore mined	$1.58
Interest for 2 years at 4 percent ($46,280) for each long ton of ore	.18
	1.76

Operating Costs

First case (for each long ton of ore mined):

Mining	$0.92
Crushing and hand sorting	.35
Wharfage at Claim Point	.06
Freight, Claim Point to Juneau	6.25
Milling and ore handling at Juneau	.96
Freight charges (and unloading charges at Seattle on concentrate)	2.17
Interest and amortization	1.44
	12.15

20-percent contingency	$2.43
Cost for each long ton of ore mined	14.58
Cost of each long ton of concentrate	51.12

Second case (for each long ton of ore mined):

Mining	.92
Crushing and hand sorting	.35
Milling	.96
Wharfage at Claim Point	.03
Freight charges (and unloading charges at Seattle on concentrate)	3.24
Interest and amortization	1.76
	7.26
20-percent contingency	1.45
Cost for each long ton of ore mined	8.71
Cost of each long ton of concentrate	30.53

A deficit of $7.62 a long ton of concentrates is indicated if the ore is milled at the Alaska-Juneau mill (first case). A surplus of $12.97 a long ton of concentrate is indicated if a mill is built at the mine (second case).

The Bureau of Mines has estimated that $260,000 has already been expended by Red Mountain Chromite, Inc., for equipment and development at Claim Point.

It is apparent that small changes in the freight rate from Claim Point to Juneau will considerably affect the final cost of the concentrate. It is possible that the ore might be moved at less cost by company operation of ore carriers.

The estimated results of hand-sorting operations are based upon close inspection of outcrops and drill cores. Actual results obtained may vary considerably from the estimate. If the ore is shipped to Juneau for concentration, this factor will greatly affect the final cost or the total production of concentrate because of the high freight rates, whereas the crude ore may be milled at Claim Point without hand sorting at only slightly higher cost.

It should be possible to produce concentrate from the Alaska-Juneau mill within 6 months after operations are resumed at Claim Point. It will require a year to start production if a mill is built at the mine.

CONCLUSIONS

Results of drilling and surface sampling indicate 263,000 long tons of 17.8-percent Cr_2O_3 ore available at Claim Point. Metallurgical investigations indicate that between 74,000 and 80,000 long tons of 45-percent Cr_2O_3 concentrate with a chromium:iron ratio of 2.7:1 may be recovered from this ore. Although cost of production would be less if a mill were built at the mine, saving of time and critical materials can be effected by shipping hand-sorted ore to a custom mill. Mining of 200 long tons of crude ore daily will give a yearly production of 28,000 long tons of 45 percent concentrate.

The main deposits have been sampled and outlined by core drilling. The outcrops of the smaller known deposits have been exposed by trenching where necessary. Present indications do not warrant further work by the Bureau of Mines.

Although there are many difficult and expensive operating problems in connection with these deposits, the main one is transportation. Full cooperation of the United States Government will be required in handling shipping problems.

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