UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary
GEOLOGICAL SURVEY
W. C. Mendenhall, Director

Bulletin 936-G

# CHROMITE DEPOSITS OF RED BLUFF BAY AND VICINITY, BARANOF ISLAND, ALASKA

BY

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Strategic Minerals Investigations, 1942
(Pages 171-187)

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1942

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# CHROMITE DEPOSITS OF RED BLUFF BAY AND VICINITY, BARANOF ISLAND, ALASKA

By Philip W. Guild and James R. Balsley, Jr.

## ABSTRACT

Small deposits of chromite occur in serpentinized ultramafic intrusive masses on Baranof Island, southeastern Alaska. The body of greatest importance as a possible source of chromite is at Red Bluff Bay, on the east coast of the island; seven others are known about 10 miles west-northwest, in the rugged interior. The ultramafic rocks are dunite and pyroxenite, largely altered to serpentine or talc. They are intruded into phyllite and greenstone schist of Triassic (?) age, and are cut by dikes that are probably related to the Coast Range batholith.

The ore deposits are lenticular concentrations of chromite ($(Mg,Fe)(Cr,Fe,Al)_2O_4$), a normal accessory mineral of dunite. The chromite differs widely in composition in different deposits, or even in the same deposit, but in general it has a low ratio of chromium to iron, an undesirable feature in chromite ores.

Eight deposits at Red Bluff Bay are known, of which five contain ore of shipping grade and three contain material that may be of concentrating grade; but the estimated reserves amount to only 570 tons of ore containing 40 percent or more of chromic oxide ($Cr_2O_3$), and about 29,000 tons of low-grade material averaging 12 percent of chromic oxide. No deposits of economic importance are known to occur in the interior of the island.

## INTRODUCTION

Chromite is present in a number of ultramafic intrusive bodies on Baranof Island, southeastern Alaska, in latitude 57° N., longitude 135° W. (fig. 15). Baranof Island is very rugged, with a relief of nearly 5,000 feet, and it bears abundant evidence of glacial action, such as U-shaped valleys, cirques, and deep gouges in rock surfaces, but only a few small glaciers remain at present.

Some of the ultramafic masses are high in the mountains in the central part of the island, but the one that offers the most hope as a source of chromite is at Red Bluff Bay, a deep fiord opening into Chatham Strait near the middle of the east coast of the island. Red Bluff Bay takes its name from the bare,

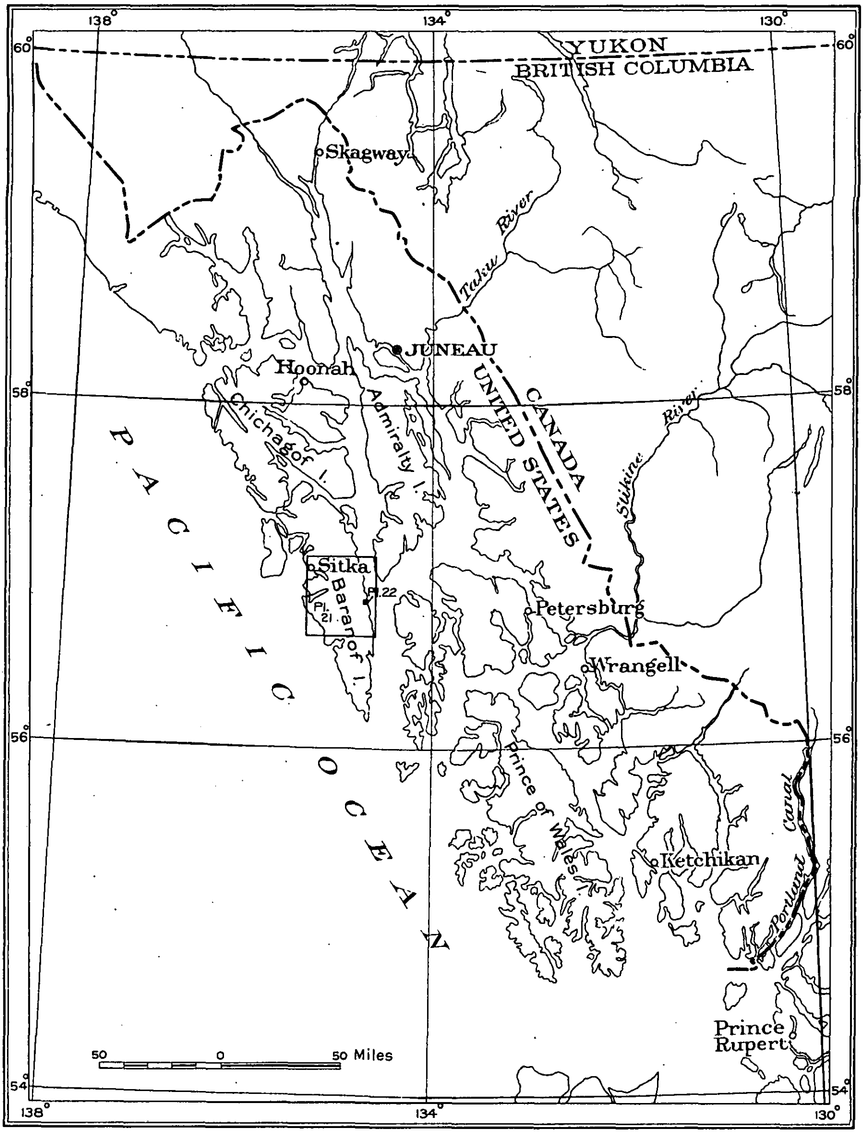



Figure 15.--Index map of southeastern Alaska showing location of the Red Bluff Bay area.

reddish-brown, weathered surface of the ultramafic rocks. Chromite-bearing rocks underlie an area of $1\frac{1}{4}$ square miles on a long ridge north and east of the bay, and some crop out on several small islands in the mouth of the bay. Steep slopes rise from the shore to the crest of the ridge, which ranges in altitude from 500 to 1,200 feet.

A cannery in the bay burned down about 1935, and since that time there has been no industrial activity in the area. The nearest settlement is Baranof, at Warm Springs Bay, 18 miles north. Red Bluff Bay is only 26 miles from Sitka, but as it lies across the island from Sitka it can be reached from there only by plane or by boat, which must go some 100 miles around the island. A mail boat from Petersburg calls at Baranof once a week. The only practicable method of reaching the area is by chartering a plane or boat from Juneau, 140 miles north, from Petersburg, 80 miles east, or from Sitka.

At sea level, the climate is relatively mild, but the rainfall is probably between 100 and 200 inches a year. Over the higher parts of the island the snowfall is usually very heavy.

Chromite was recognized at Red Bluff Bay by Ray Race about 1933. Twenty-eight claims, covering nearly the entire area of outcrop of the chromite-bearing rocks, were then staked, but within a few years they were allowed to lapse, and no mining on them was ever attempted. About 1935, chromite was found in the serpentine masses in the central part of the island by Joe Hill, and a number of claims were staked, but these also have been abandoned.

The Red Bluff Bay area was examined briefly for the Geological Survey by John C. Reed and others in 1939. During the summer of 1941 the writers, with R. E. L. Rutledge, mapped this area on a scale of 1:12,000 (see pl. 22), and examined the serpentine masses in the interior during the course of reconnaissance trips into the surrounding region (pl. 21).

The writers wish to express their appreciation to John C. Reed for his guidance both in the field and in the office, and also to George O. Gates for his many valuable suggestions.

## GEOLOGY

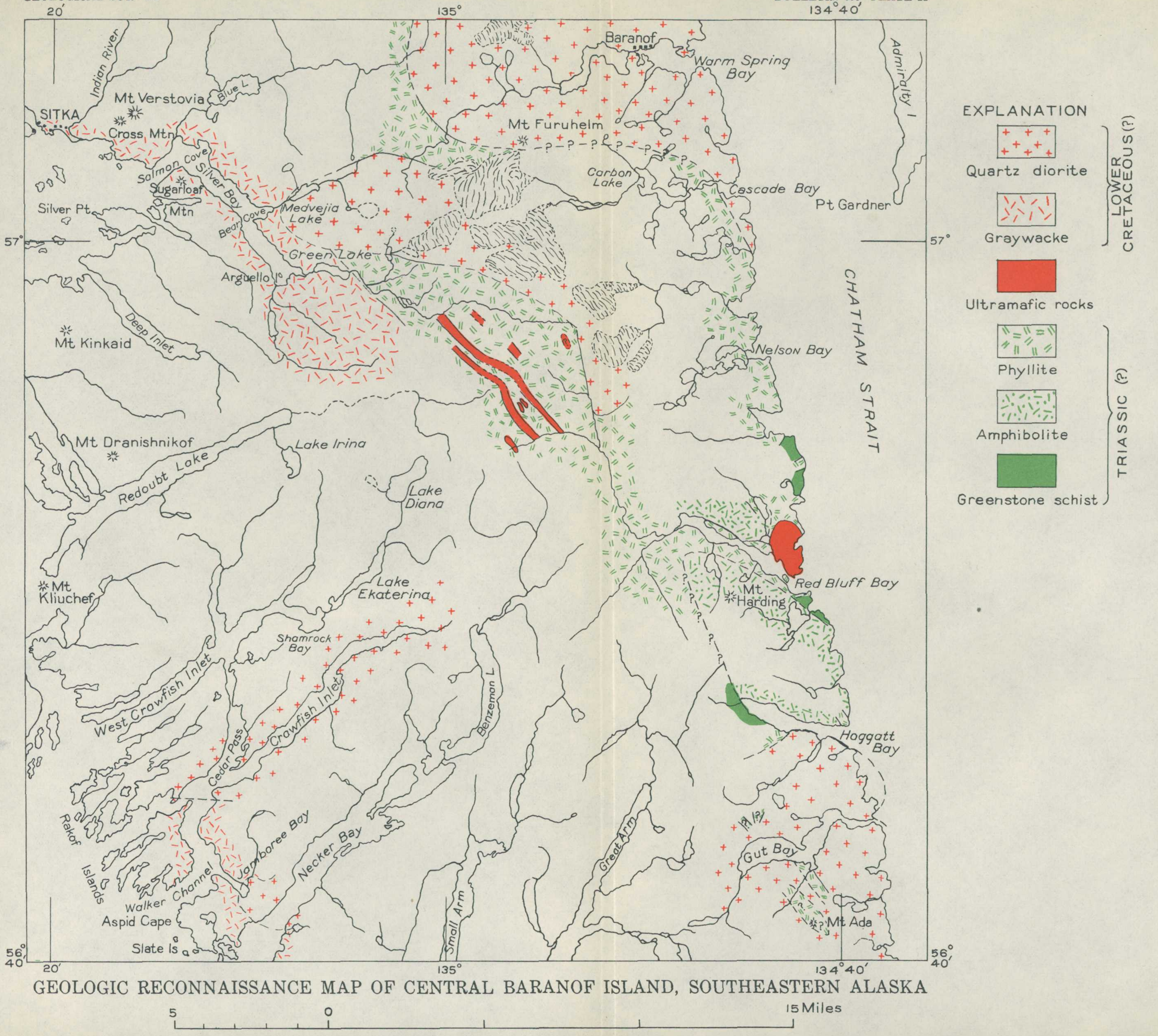
The chromite of Baranof Island is present as small lenses, thin layers, and disseminated grains in ultramafic rocks, which intrude a sequence of phyllites and greenstone schists of Triassic (?) age. There is some evidence that the intrusion took place during the last stages of the deformation that metamorphosed the sediments. The most accessible and best known of the intrusive masses is at Red Bluff Bay. Seven others are known in the central part of the island, about 10 miles west-northwest of Red Bluff Bay, and there may well be more that have not been seen. The masses in the interior appear to be sills, but that at Red Bluff Bay, which is less well exposed, is more complex. Younger dikes cut both the metamorphic and the ultramafic rocks.

### Metamorphic rocks

The invaded rocks comprise a thick sequence of phyllites and greenstone schists which have been tentatively correlated with rocks of similar appearance in the Chichagof district, Chichagof Island, about 80 miles northwest of Red Bluff Bay. These rocks are regarded by Reed and Coats 1/ as Upper Triassic (?).

The rocks here designated phyllite were formed by the metamorphism of fine-grained detrital material. The phyllite includes dark, very fine grained graphitic shale, with or without megascopic biotite flakes; fine-grained quartz-biotite schist; thinly laminated siliceous rocks grading into chert; and some limestone in lenses a few feet thick. Interbedded and intermixed with these rocks are green chlorite schists, probably derived from volcanic ash which was deposited in water contemporaneously with the associated detrital material. Some of

1/ Reed, J. C., and Coats, R. R., Geology and ore deposits of the Chichagof mining district, Alaska: U. S. Geol. Survey Bull. 929, pp. 24-30, 1942.




GEOLOGIC RECONNAISSANCE MAP OF CENTRAL BARANOF ISLAND, SOUTHEASTERN ALASKA the green schist is extremely fine grained, but it grades into coarser-grained rocks in which plagioclase and occasionally biotite or hornblende can easily be seen. The coarse-grained rock, mapped as amphibolite, is believed to have been recrystallized by contact action of the diorite batholiths of the vicinity.

The greenstone schist and phyllite sequence is overlain on the west by graywacke, believed to be identical with the graywacke of probable Lower Cretaceous age which occupies the same stratigraphic position in the Chichagof district.[2]

## Igneous rocks

### Ultramafic rocks

Ultramafic intrusive rocks are rich in magnesia and iron and deficient in alkalies and silica; their characteristic minerals are olivine and pyroxene, and they commonly carry chromite as an accessory mineral. The ultramafic rocks at Red Bluff Bay are predominantly dunite, which is rich in olivine, and pyroxenite, which is rich in pyroxene. In places these two materials are finely interlayered and form a rock that has the bulk composition of a peridotite, composed of both olivine and pyroxene.

Dunite.--The fresh dunite is hard and granular, with a gray, glassy appearance on unweathered surfaces. Accessory chromite grains, many with crystal faces, are commonly present. Optical tests indicate that the olivine ($(Mg,Fe)_2SiO_4$) has an Mg:Fe ratio of about 95:5. The dunite at Red Bluff Bay, except in a small area near the center of the mass, has been more or less altered to serpentine, a rock in which the olivine has been replaced by antigorite ($H_4Mg_3Si_2O_9$). The serpentine is a compact, tough rock, dark green on fresh surfaces but weathering to the characteristic reddish-brown color. It also contains

2/ Reed, J. C., and Coats, R. R., op. cit., pp. 30-35.

varying proportions of ankerite ($Ca(Mg,Fe)(CO_3)_2$), with magnesium present in larger amounts than iron.

Masses of schistose talc ($H_2Mg_3Si_4O_{12}$) have been developed by the alteration of serpentine, and perhaps also directly from the original silicates, olivine and pyroxene. Many of the talc masses lie along shear zones, but a few, of irregular shape, are not related to any known faults. Serpentine, ankerite, and talc are found here and there in narrow veins as well as in the altered rock.

Pyroxenite.--The fresh pyroxenite is composed of a green monoclinic pyroxene of the variety diopside ($Ca(Mg,Fe)(SiO_3)_2$). It is in general a medium-grained rock, with the grain size ranging from a few millimeters to several centimeters. It is easily distinguished from dunite by its gray weathered surfaces, and by the prominent pyroxene cleavage faces on fresh surfaces. Accessory chromite is much less common than in the dunite, and ordinarily can be seen only under the microscope. Although the pyroxenite usually forms layers, lenses, or larger irregular bodies, dikelets of fresh pyroxenite cut the dunite in a few places.

The pyroxenite has commonly been altered to a fibrous amphibole which in turn is more or less replaced by carbonate, talc, and antigorite. The altered rock surface weathers to a soft, dirty gray which contrasts sharply with that of the dunite.

## Other igneous rocks

Biotite-bearing and hornblende-bearing quartz diorite also intrude the metamorphosed sedimentary rocks in the area around Red Bluff Bay (pl. 21). These batholithic rocks are light-colored and granular and are made up of roughly 60 percent of feldspar, which is largely andesine but includes a little orthoclase; 30 percent of quartz; and 10 percent of biotite or hornblende and accessories. These batholiths are considered to be offshoots from the Coast Range batholith, which is probably of Lower Cretaceous age.

The nearest batholithic rocks are 4 or 5 miles from the ultramafic mass at Red Bluff Bay, but numerous dikes believed to be genetically related to them cut across both the sedimentary and intrusive rocks in the Red Bluff Bay area. The dikes are porphyritic hornblende andesites, ranging in color from white to dark gray, and in width from a few inches to 15 feet or more.

Diabase dikes, consisting of andesine laths and augite in approximately equal proportions together with minor quantities of biotite and magnetite, cut the serpentine and the metamorphic rocks. They are probably younger than the hornblende andesite dikes and unrelated to them, although the evidence is not conclusive.

## Structure

The structure of most of the western side of Baranof Island appears to be relatively simple. The beds are overturned, with the younger graywacke and underlying older phyllite and greenstone schist striking N. 30°-50° W. and dipping steeply northeast. (See pl. 21). The ultramafic masses of the interior of the island are also simple in form, being concordant, sill-like bodies which strike about N. 50° W. and dip steeply northeast, parallel with the overturned bedding in the phyllite.

In the vicinity of Red Bluff Bay the phyllite and greenstone schist lie in somewhat open folds, with axes trending about N. 30° W. and plunging 10°-50° SE. (see pl. 22). A strong lineation and much minor tight crumpling have developed in the weaker beds, and a prominent set of joints cuts the rocks at about right angles to the axes of folding. Most of the contact of the intrusive ultramafic mass is below sea level, but at the north end of the mass the contact seems to indicate that the mass is concordant and spoon-shaped, plunging to the south.

The intrusion appears to have taken place during the later stages of the period of deformation in which the surrounding sediments were folded and metamorphosed.

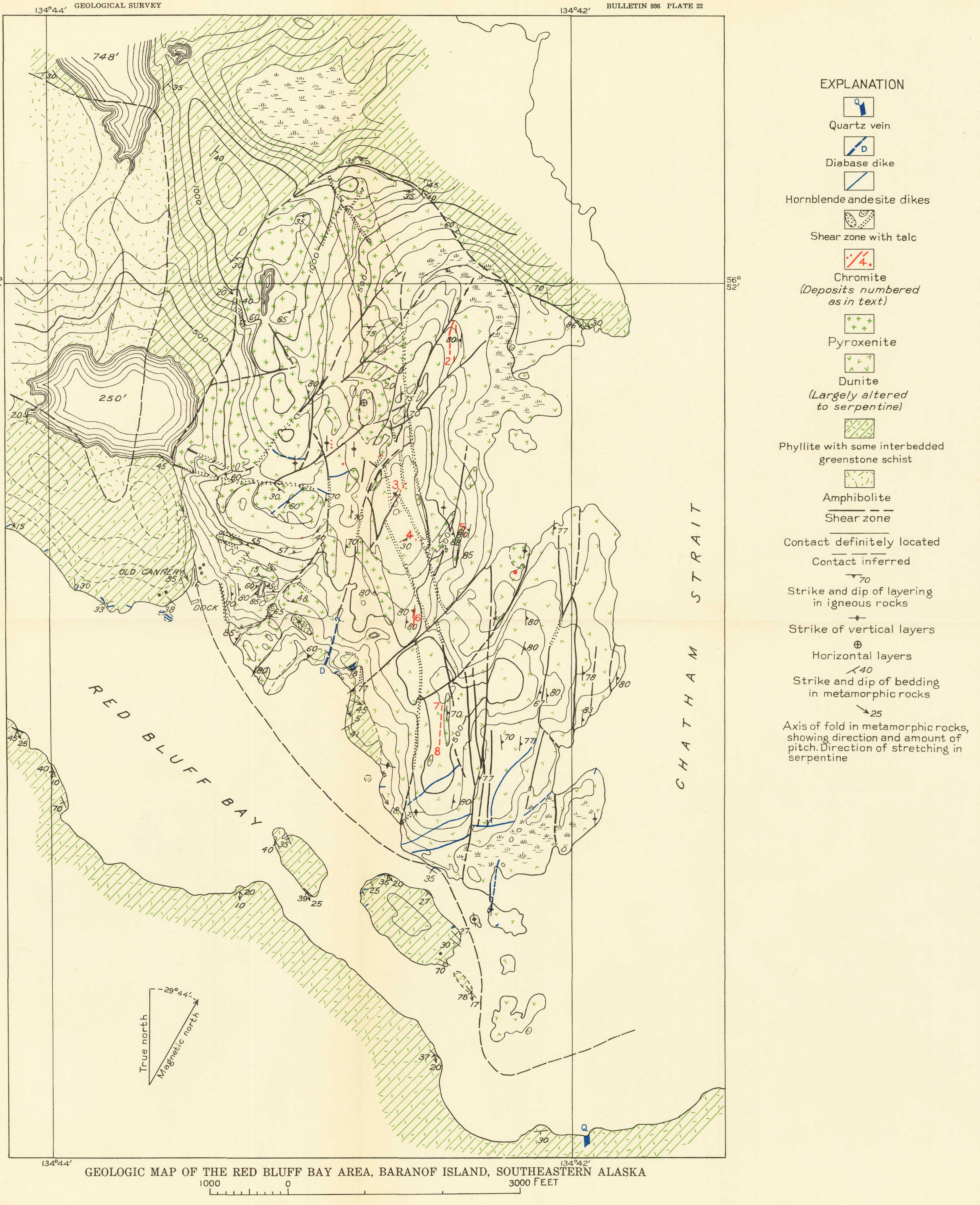
The internal structure of the mass is complex (see pl. 22). Pyroxenite predominates in the northwestern half of the area and crops out in large irregular lenses. Throughout most of the exposed area the dunite shows a more or less regular banding caused by pyroxene-rich layers in the rock. In the southeastern half this feature is well developed—the strike of the layers there deviates only slightly from north, and the dip is everywhere very steep. Chromite-rich layers or lenses in dunite lie parallel to the pyroxene-rich layers, but in general they are narrow and discontinuous.

These structures are believed to be due to a flow banding of inhomogeneous material partially differentiated in depth, in which the massive pyroxenite bodies were localized for the most part near the bottom—the periphery and northwestern half, in particular, of the mass now exposed—while the individual grains of pyroxene and chromite were being swept along in the currents and formed the well-banded type of rock.

Shear zones are abundant and prominent in the ultramafic rocks. They fall in general into two sets, those of one striking about north and those of the other northeast. The northeasterly-trending set usually displaces the other, but in a few places the reverse is true. The shear zones are younger than the hornblende andesite dikes, but older than the diabase dike, which follows one of them. Talc has developed along them in many places.

## CHROMITE DEPOSITS

Small tabular or lenticular masses of chromite occur at a number of places in the ultramafic rocks. A few may be of some




GEOLOGIC MAP OF THE RED BLUFF BAY AREA, BARANOF ISLAND, SOUTHEASTERN ALASKA slight economic importance, but the outlook is not encouraging for a substantial production from this area.

## Mineralogy

Chromite is a black, hard, heavy mineral with a submetallic luster and a brown streak. It may occur in octahedrons, but it more commonly forms irregular grains or irregular aggregates of grains. It is not uniform in composition, but contains varying proportions of chromium, iron, magnesium and aluminum oxides. The formula is usually written as $(Mg,Fe)(Cr,Fe,Al)_2O_4$. The important considerations from an economic standpoint are the percentage of chromic oxide ($Cr_2O_3$), and the ratio of chromium to iron. Analyses of ore from Red Bluff Bay show a wide range in these factors, but all the samples were too rich in iron to be ore of metallurgical grade, which should contain 48 percent or more of $Cr_2O_3$ and have a Cr:Fe ratio of 3:1 or better. A rough estimate of the Cr:Fe ratio may be made on the basis of the magnetism of the mineral and the color of its streak, the magnetism increasing and the streak becoming darker brown with increasing iron content.

## Localization and origin of ore bodies

The chromite is found in thin tabular bodies which lie parallel to the pyroxenite layers. The ore bodies are restricted to the dunite areas. If the large pyroxenite masses are localized near the bottom of the intrusive, as some evidence seems to indicate, it is probable that the lower parts of the ultramafic body will be practically free of chromite, for no appreciable concentration of that mineral has been discovered in the pyroxenite.

The similarity in shape and mode of occurrence between the chromite-rich and pyroxene-rich layers or lenses indicates that there was no essential difference in the method of origin of the two. Chromite grains were probably concentrated into irregular masses before the ultramafic rocks were intruded into their present position, the tabular shapes of the deposits being produced by the flow of the magma. The chromite began to crystallize out of the magma somewhat earlier than the silicate minerals, but the periods of crystallization overlap. Late dikelets of olivine and pyroxene cut the chromite and early formed silicate grains, indicating that some movement and fracturing occurred before the final consolidation of the magma.

## Ore bodies

Several small chromite bodies are known in the serpentines of the interior of Baranof Island, but none of them appear to offer any hope for production, particularly in view of their inaccessibility. They may contain a few dozen or a hundred tons in all. The lack of high-grade chromite float in the interior indicates that there are few or no large deposits.

The chromite deposits at Red Bluff Bay are for the most part either too small or of too low grade to be of economic importance, but five bodies containing from a few tons to a few hundred tons apiece may be of sufficiently high grade to be mined and shipped without concentration. These deposits range from a few feet to a few tens of feet in length and are all narrow; in only a few places is there a width of more than 1 foot of solid ore. Layers of barren dunite commonly separate the high-grade chromite layers, and will make careful hand-sorting necessary if even a very small production is to be obtained.

Three deposits of larger dimensions but of lower grade are known. These are from 100 to 300 feet long and 1 foot to about 30 feet wide, and are estimated to have depths of one-half their lengths. These low-grade bodies are chromite-rich masses of dunite in which the chromite is disseminated as small pods and lenses of solid ore. Most of these pods and lenses, even though they are of shipping grade, are much too small to be mined separately; the grade of the chromite-rich masses may be high enough, however, to make the deposits concentrating ore.

In the table of analyses below, the concentrates represent the pure chromite mineral, separated from the silicate minerals by laboratory methods. The percent-chromite column gives the percentage of chromite by weight in the sample.

Partial analyses of chromite samples from Red Bluff Bay, Alaska
[R. E. Stevens, analyst]

| Sample number | Concentrate | | | | Crude ore | |
|---|---|---|---|---|---|---|
| | Cr (percent) | Fe (percent) | Cr:Fe | $Cr_2O_3$ (percent) | $Cr_2O_3$ (percent) | Chromite (percent) |
| AG41-87 | 33.40 | 23.17 | 1.44 | 48.80 | 25.48 | 52 |
| AG41-88 | 35.70 | 18.48 | 1.93 | 52.19 | 29.09 | 56 |
| AG41-86 | 35.96 | 16.66 | 2.16 | 52.55 | 40.13 | 76 |
| AB41-12 | 39.30 | 18.05 | 2.18 | 57.44 | 50.56 | 88 |
| AG41-48 | 36.48 | 20.87 | 1.75 | 53.30 | 34.80 | 65 |
| AB41-25 | 36.00 | 20.28 | 1.78 | 52.59 | 47.66 | 91 |
| AG41-49 | 38.27 | 18.88 | 2.03 | 55.91 | 46.38 | 83 |
| AG41-69 | 37.02 | 22.12 | 1.67 | 54.12 | 18.65 | 34 |
| AB41-19 | 33.05 | 23.51 | 1.41 | 48.29 | 43.10 | 89 |
| AB41-18 | 36.97 | 18.67 | 1.98 | 54.01 | 46.30 | 86 |
| AG41-46 | 23.50 | 33.58 | .70 | 34.32 | 20.08 | 59 |
| AG41-47 | 33.47 | 28.51 | 1.17 | 48.90 | 24.45 | 52 |

AG41-87. From south end of deposit No. 1.
AG41-88. From north end of deposit No. 1.
AG41-86. From north lens of deposit No. 2.
AB41-12. From deposit No. 3.
AG41-48. From deposit No. 4.
AB41-25. From deposit No. 5.
AG41-49. From south end of deposit No. 6.
AG41-69. From north end of deposit No. 6.
AB41-19. From deposit No. 7.
AB41-18. From high-grade lens, deposit No. 8.
AG41-46. From narrow layers 1,000 feet west-northwest of deposit No. 3.
AG41-47. From chromite lens 500 feet northwest of deposit No. 3.

The deposits described below include all the ore bodies from which any appreciable amount of chromite could be obtained that are known to occur at Red Bluff Bay, and the good exposures in most of the area near the bay make it unlikely that any large bodies there have escaped notice. No description of deposits in the interior of Baranof Island is given because too little is known about them.

No. 1.--A northward-trending zone, about 600 feet long, carrying chromite stringers and blebs, lies at an altitude of about 350 feet on the east slope of the main ridge, near the northern end. In the northern part of this zone, rich layers of chromite in dunite striking N. 20°-35° E. and dipping 85° W. extend for about 300 feet through a width of from 1 to 5 feet. Two samples, AG41-87 and AG41-88, containing respectively 25.5 percent and 29.1 percent of chromic oxide, indicate that about half the material is chromite. (See p. 181.) The ore is well exposed on a sloping surface for most of its length, and at the north end a cliff exposes it for 70 feet vertically. The total relief on the outcrop is some 130 feet. This deposit affords the best hope for a relatively large tonnage of concentrating ore.

No. 2.--Deposit No. 2, the best in the area, is at the southern end of the chromite-rich zone in which No. 1 is found. It consists of two masses of high-grade ore (sample AG41-86 shows 40.1 percent chromic oxide), apparently segments of one vertical, northward-trending body that is cut by a fault striking east and dipping 30° S. This southern segment is 50 feet long and 1 to 2½ feet wide but is cut off at the bottom by the fault. The northern segment is exposed for 40 feet horizontally and 42 feet vertically and is from 1.6 to 3.9 feet wide; it lies beneath the fault plane, so that the possibility of a southerly continuation and of a greater depth is increased.

No. 3.--Deposit No. 3 is at an altitude of more than 700 feet on the crest of the ridge in the center of the exposed dunite mass. It comprises three small pods of high-grade ore, a sample of which (AB41-12, p. 181) contains 50.6 percent of chromic oxide. The largest and most southerly of these pods is a mass of chromite 4 feet high and 4 feet long, exposed in a low cliff. It pinches out at the top, but is 2 feet wide at the base of the exposure. About 50 feet north of this a small semispherical body of chromite 3 feet in diameter crops out, and a still smaller body occurs 30 feet farther north.

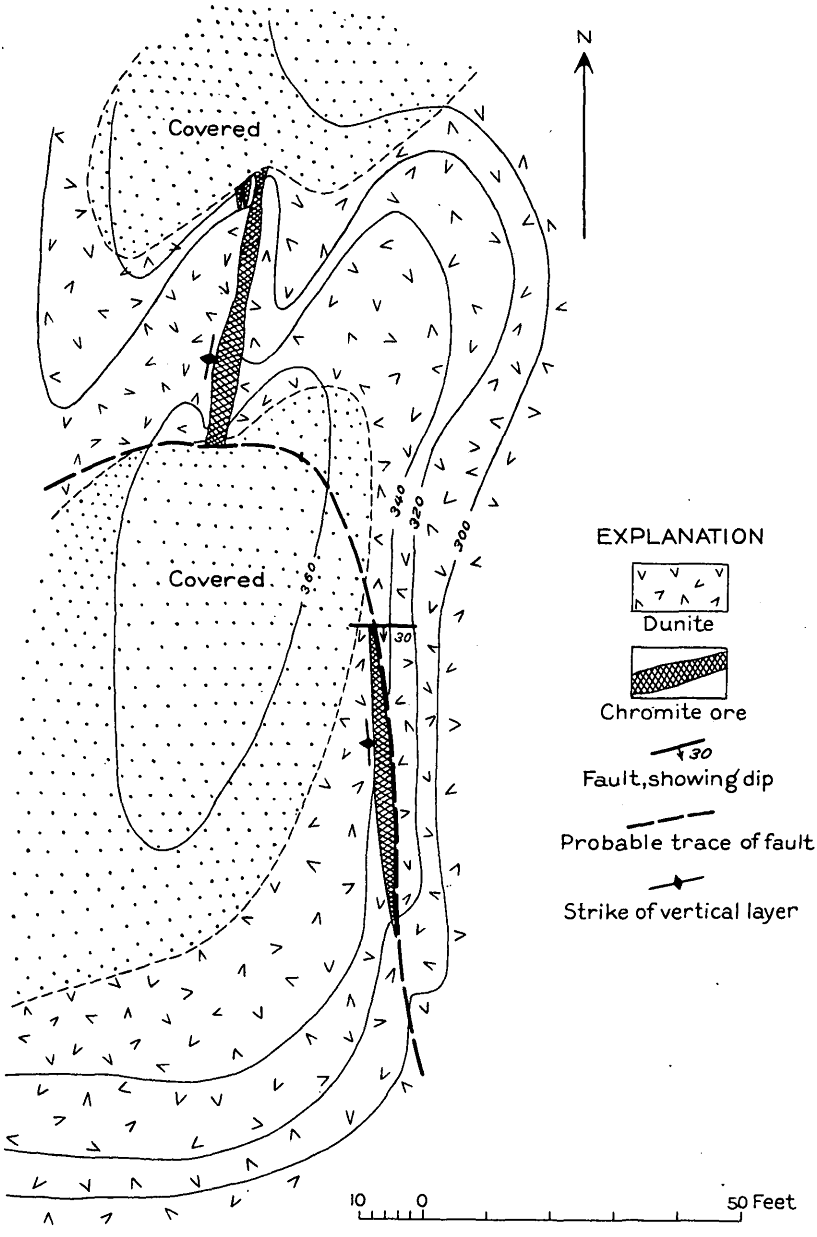



**Figure 16.--Geologic sketch map of deposit No. 2.**

No. 4.--A low-grade body of chromite crops out on the crest of the ridge 600 feet south of deposit No. 3. It consists of several thin layers of chromite in a zone about 2 feet thick which strikes N. 60° E. and dips 30° SE. Sample AG41-48 (p. 181), containing 34.8 percent of chromic oxide, represents one of the better layers. The zone is about 10 feet long; at the southwest end it is cut off by a fault, at the northeast end the ore pinches out.

No. 5.--Deposit No. 5 is at an altitude of 280 feet on the east slope of the main ridge. A zone 1 foot thick of thin lenticular chromite masses strikes north and dips 75° W. A fault cuts it off at the south end; 10 feet to the north it is exposed in a vertical cliff, which is its northernmost outcrop. It apparently has a depth of 10 feet, for it pinches toward the top and bottom. The analysis of sample AB41-25 (p. 181), indicates that this ore contains 47.7 percent of chromic oxide.

No. 6.--Deposit No. 6 crops out on a high bench at the top of the large cirque south of No. 5. A long narrow body of chromite extends nearly 300 feet, striking N. 10° E. and dipping 80° W. The southernmost 100 feet is a single layer of good chromite (sample AG41-49, 46.4 percent of chromic oxide) ranging from 1 to 18 inches in thickness. To the north the ore breaks up into many 1- to 2-inch chromite-rich layers separated by barren dunite. Sample AG41-69 (18.7 percent of chromic oxide) was cut across this lower-grade part of the deposit. The thickness of the zone increases to about 5 feet at the north end. The body has been faulted and offset slightly at many places, and at the north end it is cut off by a major shear zone. It pinches out to the south.

No. 7.--Small stringers of chromite are found in a northward-trending zone about 600 feet long that is exposed on the crest of the main ridge at its southern end. The largest of these bodies, known as deposit No. 7, is at the north end of this zone. It consists of narrow layers of good ore, striking N. 10° E. and dipping 65° E. A sample of this ore (AB41-19,

p. 181), contains 43.1 percent of chromic oxide. The individual layers are from 1 to 6 inches thick, two of them being 4 and 6 inches thick, respectively, and the zone has a total width of some 2 feet. It is exposed at the south end in a steep outcrop, from which it can be traced continuously for 20 feet north and intermittently for 30 feet more. Several small faults offset the zone 1 to 6 inches.

No. 8.--Deposit No. 8 is at the southern end of the zone in which No. 7 occurs. An area about 30 feet wide and 100 feet long contains many layers of disseminated chromite, together with irregular lenses, up to a foot long, of much higher-grade material. Sample AB41-18 (p. 181), is from one of these small lenses. The high-grade lenses are too small to mine individually and would have to be included with the low-grade material. Even with these lenses the deposit is of very low grade, probably averaging about 5 percent chromic oxide, which is too little to be considered economic.

## Reserves

In the table of reserves given on the following page the deposit numbers correspond to those given on the map (pl. 22). Figures are long tons. The grade of the ore is taken from the table on page 181, except that of deposit No. 8, which is estimated. It should be remembered that the ore is so variable in dimensions and grade that these figures are only a rough approximation, and also that they are based only on outcrops.

The method of origin of these deposits leads to the belief that they were probably about as long in the vertical as in the horizontal dimension before erosion exposed them. Some have undoubtedly been entirely removed, and others almost certainly exist that do not crop out. The average depth of those known at present has been assumed for the purposes of this report to be about half the length.

Chromite is unaffected by chemical processes of weathering; therefore the ore has been neither leached nor enriched near the surface.

Estimated reserves of chromite at Red Bluff Bay, Alaska

| Deposit number | Possible shipping ore | | Possible concentrating ore | | |
|---|---|---|---|---|---|
| | Long tons | $Cr_2O_3$ (percent) | Long tons | $Cr_2O_3$ (percent) | Chromite (long tons) |
| 1...... | ... | .... | 9,000 | 27.3 | 4,860 |
| 2...... | 230 | 40.1 | ...... | .... | ..... |
| 3...... | 10 | 50.6 | ...... | .... | ..... |
| 4...... | ... | .... | 10 | 34.8 | 7 |
| 5...... | 5 | 47.7 | ...... | .... | ..... |
| 6...... | 250 | 46.4 | 5,000 | 18.6 | 1,700 |
| 7...... | 75 | 43.1 | ...... | .... | ..... |
| 8...... | ... | .... | 15,000 | (?) 5 | (?) 1,500 |
| Total | 570 | .... | 29,010 | Weighted average 12 | 8,067 |

The high-grade deposits are very small, but several factors make them attractive for development. The area is easily accessible by water, and the ore bodies are not over one-fourth of a mile from the beach; No. 2, the best deposit, is only 500 feet from the low-lying valley of the creek flowing from the northern cirque. Little mining equipment would be necessary—a compressor could be set on the beach, and air taken to the deposits by pipe-line—and mining costs therefore would probably be low. A small outfit could mine out the known deposits quickly, perhaps with men and equipment from some intermittently active mine during a period of slack. The ore could be transported readily to the beach, and to a shipping point such as Petersburg by a small boat. Shipping costs from Petersburg to Seattle would be about $4 per ton.

The situation with regard to the low-grade bodies is very different. Although the table shows some 29,000 tons of concentrating ore, this figure is based on surface exposures only. In order to produce possibly 8,000 tons of concentrates, extensive development work and milling tests would have to be made and a mill would have to be built, all of which would require a large investment with little prospect of an adequate return.

The high iron content of the chromite of these deposits makes them less desirable than they would otherwise be, and more extensive deposits of such ore are available elsewhere.

The few high-grade bodies may afford a small, readily available source of a few hundred tons of chromite, but there is little prospect that future reserves of any consequence can be developed in this area.

O