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ILMENITE-BEARING BEACH SANDS NEAR LITUYA BAY, ALASKA

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ILMENITE-BEARING BEACH SANDS NEAR LITUYA BAY, ALASKA

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INTRODUCTION

The beach deposits that are described in this report lie along the west coast of southeastern Alaska, between Dixon Harbor and a point a few miles northwest of Cape Fairweather (see map). Most of these beach deposits contain concentrations of heavy minerals, including ilmenite, and in places some gold and platinum, in their upper part. Since 1894 the deposits occasionally have been mined for gold.

The beach deposits a few miles on either side of Lituya Bay were described briefly by J. B. Mertie (1933) who visited the area in 1917. In 1952, when the writer was engaged in geologic mapping of the Fairweather Range, he made a cursory examination of the beaches between Dry Bay and Dixon Harbor; the information thus gained is the basis of the present report. The beaches from Dixon Harbor to a point 7 miles northwest of Lituya Bay were traversed on foot. Northwest of this point the beach was examined and samples taken at about 5-mile intervals as far as the northwest side of Dry Bay, with the use of a wheelplane.

At present the map area contains no permanent residents. One abandoned cabin still stands on Cenotaph Island in Lituya Bay, and another near the mouth of the Kaknau River. A wagon road, now overgrown, connects Lituya Bay with the sand beaches to the northwest; a foot trail

extends from Lituya Bay to the sand beaches to the south, and from Kaknau River to the large river valley at the northeast corner of Palma Bay. Commercial fishing is actively practiced off the coast, and a fish buyer regularly maintains a base at Dixon Harbor during the summer months.

The weather is comparable to that of the rest of the coastal areas of southeastern Alaska. In general the climate is mild and humid. June is generally the dryest month and October the wettest. The total annual precipitation at Cape Spencer, 25 miles to the southeast, is about 116 inches and the average annual temperature is about 45 degrees. Fog characteristically covers the coastal area during intervals of otherwise good weather, but appears to be somewhat less common at Lituya Bay than it is at Icy Point. During the winter months severe storms are common in the area.

Forests with trees several feet in diameter now cover the upper parts of the beaches and alluvial fans northwest of Lituya Bay. The main trees are Sitka spruce, hemlock, and yellow cedar. Most of the forests are dense and filled with fallen timber and undergrowth, which consists of alder, devil's club, blueberry, high-bush cranberry, and gooseberry. Numerous grasses, sedges, and broad-leaf plants are present, and in shaded areas moss covers the ground and hangs from the trees. The areas from which the glaciers have receded within the last few years are covered with a dense growth of alder, spruce, and devil's club.

GEOLOGY

General relations

The beach deposits shown on the map in the area between Icy Point and Lituya Bay probably lie on bedrock or on glacial outwash or moraine. Most of those shown east of Icy Point overlie stream gravels, and those north of Lituya Bay probably overlie bedrock or glacially derived gravels. All the beach deposits except those of the modern bare beaches have in part been covered by alluvial fans, glacial outwash, or, in some places northwest of Lituya Bay, by swamp deposits.

Description

The beach deposits consist of well-sorted sand. They comprise the modern bare ocean beach; a somewhat older, but genetically related tree-covered portion of the modern beach; and still older beaches, also tree-covered. These latter, because they belong to earlier cycles of deposition, are termed relict beaches in this report.

The vegetation-free parts of the modern beaches range in width from a few tens of feet to nearly one thousand feet. In general the bare beaches are widest northwest of Lituya Bay and are about 300 feet wide on the average for the map area. The tree-covered part that is visible on the aerial photographs northwest of Lituya Bay ranges from 800 to 2,700 feet wide and averages about 1,300 feet wide. In some places northwest of Lituya Bay the modern beach is separated from the mainland by a swampy area that may be underlain by beach deposits. The

tree-covered beach area is absent in some places south of Lituya Bay and where present is limited to a maximum width of a few hundred feet. No extensive relict beaches have been detected southeast of the bay, but some are visible on photographs northwest of the map area; just northwest of Dry Bay, the beaches comprise a coastal plain over 5 miles wide.

Heavy mineral concentrations

The upper parts of all the bare beach deposits shown on plate 1 contain concentrations of heavy minerals, some of which extend over considerable areas--areas on the order of several hundred feet wide and as much as several miles long. The concentrations consist of beach sands containing 5 to 40 percent of heavy minerals. They may be small patches a few feet long and a few feet wide, or they may comprise almost the entire upper part of a large beach deposit. For example, the upper part of the beach sand southeast of Lituya Bay contains 20 to 40 percent of heavy minerals; this concentration extends for almost the full length of the beach, a distance of approximately $2\frac{1}{4}$ miles. The depth to which the concentrations of heavy minerals in the beach deposits extend is not known. Most cut banks show some layers of heavy minerals at depths at least as great as 6 feet, but the layers appear to become thinner and leaner downward.

The tree-covered beaches also contain concentrations of heavy minerals on their upper surfaces, but nothing is known of the extent of these concentrations. Probably they are similar to those found in the

vegetation-free beaches. Nothing is known concerning the existence of concentrations of heavy minerals at the toes of the upraised sea cliffs, but certainly these areas are favorable for the concentration of heavy minerals.

The main heavy minerals in the beach deposits, in their general decreasing order of abundance, are: garnet, pyroxene, ilmenite, amphibole, magnetite, staurolite, epidote, rutile, sphene, and zircon. The light material includes quartz, feldspar, mica, calcite, and small rock fragments. Table 1 shows the amount of ilmenite and magnetite in samples taken from the map area. The location from which these samples were taken is shown on plate 1.

These samples probably indicate roughly the amount of ilmenite and magnetite to be expected in the upper parts of the beach deposits. Samples a60 and b60 were samples of beach sands that showed no visible concentration of heavy minerals. One was a vertical channel sample of the top 4 feet of the beach deposits and the other was taken 11 feet below the surface, from the bottom of a pit dug in the bottom of a drainage ditch. Both samples contained about .25 percent ilmenite by weight. They probably indicate the average tenor of the beach sands where concentration has not taken place.

Table 1.--Magnetite-ilmenite content of samples from beach deposits between Palma Bay and Dry Bay.

Specimen No.	Location	Description of deposit	Magnetite (percent)	Ilmenite (percent)
Be 2	Two miles northwest of the northwest edge of La Perouse Glacier	Horizontal 5-foot channel sample taken at the top of base beach.	.2	4.0
Be 3	Same	Thin layer concentrated on modern beach.	1.5	2.0
Be 4	Three miles southeast of the entrance to Lituya Bay.	Channel sample of top 6 feet in cut bank; back of beach. (Upper limit of bare beach)	.5	3.0
Be 5	Same	Representative sample of dune 60x20x4 feet.	.1	10.0
Be 6	Four miles northwest of the entrance to Lituya Bay.	Cut bank; channel sample of a layer 2 feet thick, 6 feet below the surface. Edge of covered beach.	1.5	2.6
52ARmf7	One and a half miles northeast of Icy Point.	Channel sample; beach deposit several feet thick. (Modern beach)	.6	6.3
Be 10	Near large river just south of Dry Bay (outside map area)	Composite channel sample of cut bank, 3 layers, 6, 3, and 1 inch thick at 3, 6, and 9 feet respectively below surface.	1.8	1.6
Be 17	One mile southeast of the southeast edge of the La Perouse Glacier.	High concentration in top inch of modern beach.	10.0	21.0
a80	Near first large stream northwest of Lituya Bay.	Top 4 feet of covered beach. Sample locality showed no visible concentration of heavy minerals.	.1	.25
b80	One thousand feet northwest of first large stream northwest of Lituya Bay.	Bottom of old ditch 11 feet below present surface. (Covered beach) Sample probably represents beach sands where no concentration has taken place.	.025	.28
a81	Near b80	4-foot channel section at top of covered beach.	1.5	9.0

The titanium content of the ilmenite in four samples of beach sands has been determined chemically and semiquantitative spectrographic analyses were made for the other elements (table 2). The calculated formula of each ilmenite, assuming that the other major constituent was FeO, indicates that the ilmenite in all four samples is close to the composition of the ilmenite end member crichtonite ($FeTiO_3$). The degree to which the ilmenite departs from this formula is probably caused largely by impurities in the sample or as silicates incorporated in the ilmenite itself, and this is corroborated by the spectrographic analyses.

The beach sands contain some gold and platinum (Mertie, 1938) but their concentration is unknown. Neither was noticed in any of the samples collected but gold and platinum were not specifically sought. A few grains of gold were panned from material taken from the covered portion of the beach 3-1/2 miles north of Lituya Bay. The amount of gold in the beach sands as a whole probably is small.

Table 2.--Chemical and spectrographic analysis of ilmenite
(percent by weight)

	Sample no.			
	53ARm33a	53ARmBe1	53ARmBe6	53ARmBe7
TiO_2	52.38	46.80	47.25	48.81
Si	.1	.3	.1	.3
Al	.03	.1	.03	.1
Mg	.3	.3	.3	.3
Ca	.03	.1	.03	.1
Mn	.03	.03	.03	.03
Ba	.003	.003	.003	.003
Co	.003	.003	.003	.003
Cr	.01	.01	.01	.01
Cu	.001	.001	.001	.001
Ni	.001	.001	.001	.001
Pb	---	.001	---	.001
Sc	.001	.001	.001	.001
V	.03	.03	.03	.03
Zr	.003	.003	.003	.003

Chemical analysis of TiO_2 by A. C. Vlisidis, Geochemistry and Petrology Branch, U. S. Geological Survey.

Spectrographic analysis of all other elements by Katherine V. Hazel, Geochemistry and Petrology Branch, U. S. Geological Survey.

The heavy minerals in the beach sands are almost certainly derived from the igneous and metamorphic rocks lying northeast of the map area. Bedrock along the coast is siltstone, sandstone, conglomerate, and volcanic rocks of Tertiary age. Northeast of the coastal area is the Fairweather Range, which is made up largely of dark schist, slate, and phyllite, which in many places have been intruded by mafic igneous rock. The mafic igneous rock contains ilmenite, a small amount of magnetite, and clino- and orthopyroxene. The pyroxenes in the beach sands are identical in optical and physical properties to those in the igneous rock and furthermore they are not known to be present in any of the other rocks found in the area. Areally the ilmenite is found in abundance only along those parts of the beach that are opposite the mafic igneous rock and this distribution also suggests that the source of the ilmenite is the mafic igneous rock.

The rocks into which the mafic rocks are intruded have been highly metamorphosed and contain garnet, staurolite, amphibole, epidote, and sphene. Undoubtedly the metamorphosed rocks are the source of these minerals in the beach sands. Platinum is associated almost universally with mafic igneous rock, and probably the platinum in the beach deposits of the map area is derived from the mafic igneous rock core. The source of the gold is less certain. It may be derived from the conglomerates that make up part of the sedimentary rocks of Tertiary age, or it may come from a hydrothermally altered zone known to crop out south of Lituya Bay (Rossman, 1956).

CONCLUSION

Although the amount of information available regarding these deposits is limited, it seems to the author that further investigation of them may be warranted. Possibly the sands could be exploited for their combined content of ilmenite, gold, and platinum.

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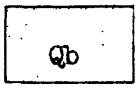
EXPLANATION

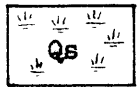


Beach sands
Does not include small or shallow deposits.

Covered beach sands
Beach-sand deposits covered by vegetation. Includes only those deposits immediately apparent on aerial photographs.

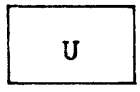
Alluvial fans
Includes some stream-washed and glacial outwash gravels.

Moraine
Includes both terminal and ground moraine deposits.



Swamp

QUATERNARY



Bedrock
Undifferentiated

Indefinite boundary of surficial deposits.

Sea cliff
Escarpment of landward edge of marine terrace.

X Be 17

Sample locality