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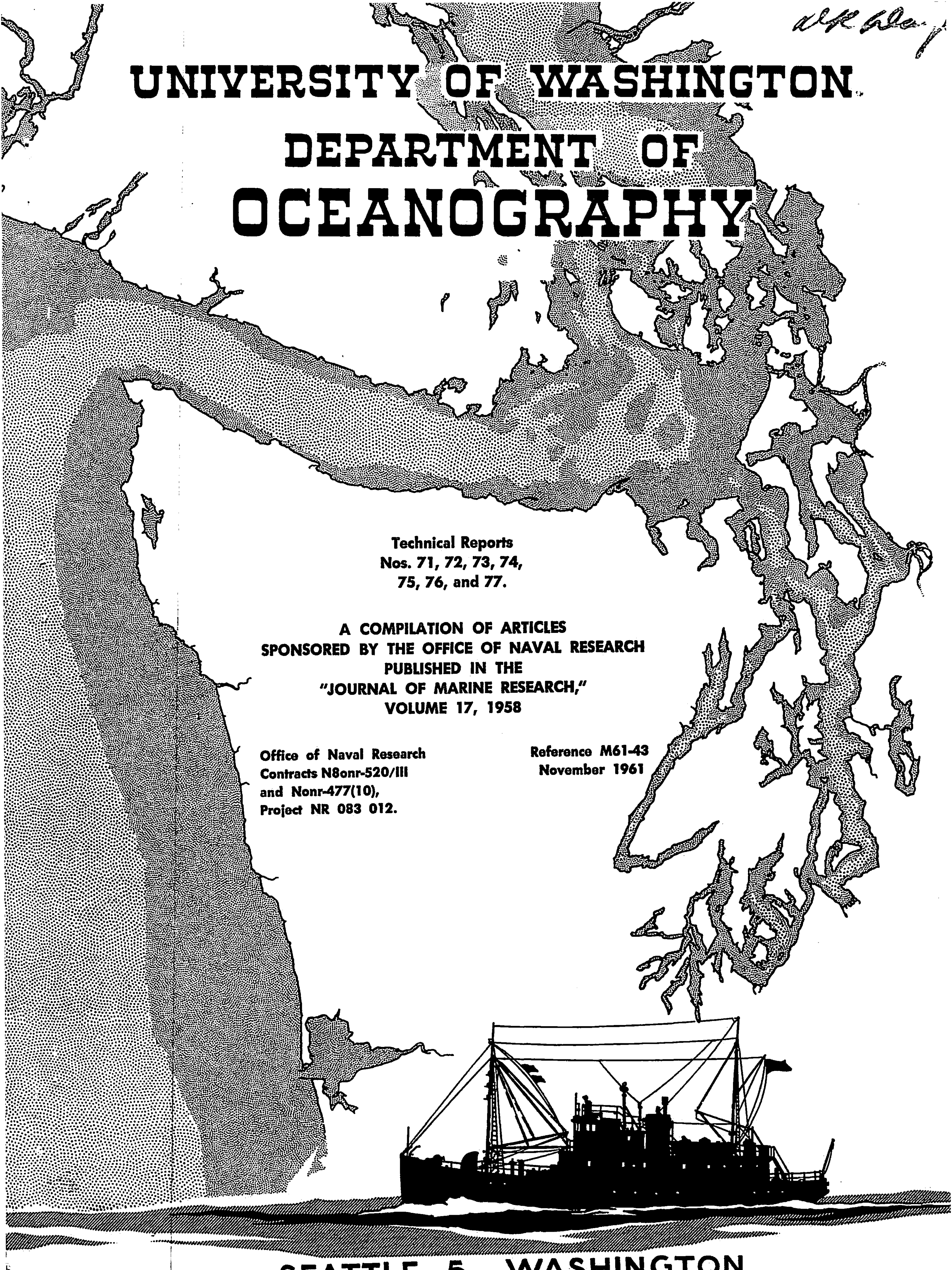

Technical Reports
Nos. 71, 72, 73, 74,
75, 76, and 77.

A COMPILATION OF ARTICLES SPONSORED BY THE OFFICE OF NAVAL RESEARCH PUBLISHED IN THE "JOURNAL OF MARINE RESEARCH," VOLUME 17, 1958

Office of Naval Research
Contracts N8onr-520/III
and Nonr-477(10),
Project NR 083 012.

Reference M61-43
November 1961

SEATTLE 5, WASHINGTON

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Seattle 5, Washington

Articles Sponsored by the Office of Naval Research Published in the Journal of Marine Research, Volume 17, 1958

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Executive Officer

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MARINE SEDIMENTS OF PRINCE OF WALES STRAIT AND AMUNDSEN GULF, WEST CANADIAN ARCTIC[1]

By

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ABSTRACT

Fifty-two marine sediment samples from Prince of Wales Strait and Amundsen Gulf have been analyzed for properties such as grain size and rock and mineral composition. It appears that the distribution of the various sediment types in the area investigated is markedly influenced by both stream location and sea ice.

INTRODUCTION

The marine sediments described in this paper were collected during the 1953 Beaufort Sea Expedition, sponsored by the United States Navy. This was the first expedition to systematically investigate the marine deposits of Amundsen Gulf and Prince of Wales Strait (see Fig. 1).

Geographic Description. Previous expeditions have provided considerable information concerning the geography and geology of this general area (Carsola, 1954a; Washburn, 1947; Chipman and Cox, 1924). The mainland east of the Mackenzie River to Cape Bathurst is a flat swampy plain, and from Dolphin and Union Strait east to Sherman Inlet on Adelaide Peninsula it is generally low and deeply indented. But in the vicinity of Tree River and Cape Barrow on Coronation Gulf the terrain is rugged. The Coppermine is the largest of several rivers in this area.

Prince of Wales Strait separates Banks Island from Victoria Island. In the southern portion of Victoria Island and along Prince

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[1] Contribution from the Department of Oceanography and Meteorology of the A. & M. College of Texas. Oceanography and Meteorology Series No. 130. Also Contribution No. 231 from the Department of Oceanography, University of Washington. Collection of sediment samples was supported by the Office of Naval Research under Contract N8 ONR 520/III with the Department of Oceanography, University of Washington.

REPRINT FROM JOURNAL OF MARINE RESEARCH, VOLUME 17, 1958

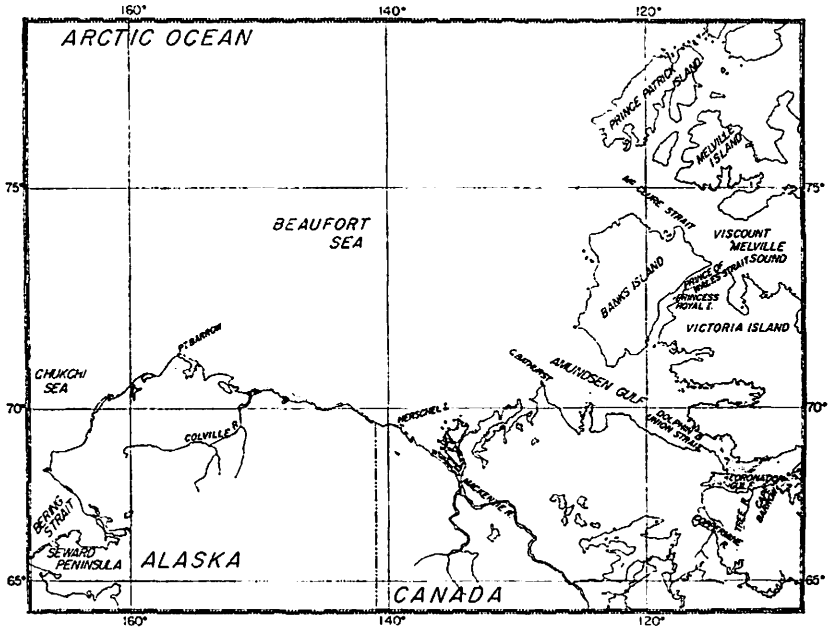

Figure 1. Map of the West Canadian Arctic.

Albert Sound the topography is generally under 300 feet, but inland elevations of about 2000 feet have been reported. In the Walker Bay area, steep shores rise to over 1000 feet. The near-shore area along Prince of Wales Strait is generally under 200–300 feet, these elevations increasing inland.

The southern part of Banks Island from Nelson Head east to Cape Lambton and then north to Thesiger Bay is characterized by steep cliffs composed of a sedimentary sequence capped with basalt which may rise to more than 1500 feet; in the southwest corner there is a plateau over 2000 feet high. The coast region from Nelson Head to DeSalis Bay and eastward is low-lying while inland the elevation increases gradually to a maximum of about 1000 feet. The Prince of Wales Strait shore area is generally under 200 feet.

Both Banks and Victoria Island show evidence of glaciation (Washburn, 1947; Porslid, 1950). An esker has been observed on the high plateau of Nelson Head and Cape Lambton, and eskers, striated stones, and erratics have been found on southern and eastern Banks Island. In the Walker Bay region of Victoria Island, also glaciated, the high plateau to the north has in the limestone many large striations which trend northwestward. Terraces on both islands up to approximately 600 feet indicate isostatic adjustment following glaciation. Although it is known that the lower terraces are former strand lines, many of the higher terraces are of doubtful origin.

Oceanographic Description. The region eastward from Icy Cape, Alaska, including Amundsen Gulf, is covered by unnavigable shorebound sea ice for about 9 to 10 months of the year (U. S. Hydrographic Office, 1946), and permanent polar ice is located approximately 40 to 60 miles north of Point Barrow, Alaska. In July the heavy ice begins to dissipate in the southern Chukchi Sea, at the mouth of the Mackenzie River, and south of Victoria Island in Dolphin and Union Strait and Coronation Gulf. During August a narrow strip of navigable ice appears along the continental shore from the Chukchi Sea to Hershell Island, just east of the Mackenzie River mouth. The strip gradually widens eastward and Amundsen Gulf is usually ice-free in August. In early August 1953 it was necessary to search for open leads only a few miles from shore in the region east of the Mackenzie River.

By September the ice begins to move back against the shore and may become land-fast at Point Barrow, although Amundsen Gulf is usually still open. Prince of Wales Strait may or may not be navigable. In October the sea again becomes ice-bound.

The wind direction and force is an important factor in the ice distribution. In August and September of 1953, during periods of north and northwest winds, Prince of Wales Strait was generally ice-bound, but during periods of southeast winds or calm weather the ice was either absent or scattered.

Wave action is usually negligible due to the relatively short fetch. The tides are mostly under one foot although Stefansson (1921) has recorded 6- to 8-foot wind tides along the western coast of Banks Island due to strong west winds. Low tides may also be associated with east winds. The currents are poorly developed and not well understood (U. S. Hydrographic Office, 1951; Carsola, 1954a).

In the western Arctic most of the soundings have been obtained off the Alaskan coast. Carsola (1954a, 1954b) has discussed the relief of the Continental Shelf and adjacent areas of the Beaufort and Chukchi seas. The Continental Shelf of the Beaufort Sea, terminating at about 30 to 40 fathoms, shows the effects of local glaciation just west of Amundsen Gulf. Shelf glaciation is to be expected in the eastern Beaufort Sea since there is ample evidence of glaciation on the southern parts of Banks and Victoria Island.

Amundsen Gulf, approximately 500 to 700 feet deep, is apparently a trough-like basin oriented WNW. Prince of Wales Strait, with a maximum depth of about 240 to 450 feet, is much shallower than Amundsen Gulf or McClure Strait.

Sediment Ice-Rafting. Ice-rafting of one type or another in the Arctic has been discussed by Nares (1878), Bancroft (1905), Stefansson (1921), Kindle (1924), Chipman and Cox (1924), Nichols (1936), Deevey (1939), Washburn (1947), LaFond *et al.* (1949), Emery (1949), Fletcher (1950), Carsola (1954a), and others.

Ice-rafting is capable of transporting sediment far from its source. In the Chukchi Sea, mud-laden ice was observed almost 200 miles from the nearest land. In early August 1953 brown sediment-laden ice was abundant in the vicinity of the Mackenzie River mouth, but in September it had disappeared; it had melted or been carried away by winds and a westerly current.

Ice islands provide an excellent means for long range sediment transport. These islands are fragments of shelf ice from Ellesmere Island over 1000 miles to the east (J. O. Fletcher, personal communications). One such island, $^1/_4$ mile wide by $^1/_2$ mile long and about 100 feet thick, was observed in Prince of Wales Strait. The surface was coated with a layer of micaceous sediment. The schists and gneisses on northern Ellesmere Island may have been the source of this sediment.

The sediments may become a part of sea ice by the following principal means:

1) Grounded sea ice freezes at the base and includes sediments. Repeated melting of the upper surface and refreezing at the base gradually bring sediments to the surface.

2) Land-fast ice picks up beach sediments on the bottom and landslides or slumping add material to the ice surface. Numerous instances of this were observed in Prince of Wales Strait; in some cases till-like soil completely covered the ice.

3) Since river ice breaks up earlier in the spring than sea ice, river waters flow out over the sea ice and deposit their load. Examples of this were observed at the mouth of small intermittent

streams on the east side of Banks Island. The ice island is another example.

4) Sediment-laden sea water freezes and facilitates ice-rafting, particularly in the vicinity of large rivers, such as the Mackenzie, where the water is quite turbid.

5) Rivers themselves, *e. g.*, the Mackenzie, carry a great deal of sediment-laden ice to sea.

6) The wind also adds to the sediment and debris on and in the ice.

LABORATORY METHODS

Grain Size Analysis. In general, the methods of mechanical analysis described by Krumbein and Pettijohn (1938) have been used. However, certain procedures deviated from the above methods.

The marine salts were removed from the sediments by washing the sample with distilled water, centrifuging and siphoning off the liquid. The samples were then mixed for 10 minutes in a 0.1 g/l solution of sodium lignosulfonate (Marasperse N) by means of an electric mixer. The wet mixture was passed through a 0.062 mm sieve, after which it was washed with the sodium lignosulfonate solution into a 1000 ml pipetting cylinder. The filtrate was then brought up to the 1000 ml volume. The coarse material, larger than 0.062 mm, was dried, weighed, and run through a series of sieves (32 to 0.062 mm). The size fractions were weighed and the fine pan fraction that remained was added to the cylinder. The filtrate was then analyzed by the standard pipette method of Krumbein and Pettijohn (1938).

Microscopic Examination. The coarse fraction was examined with a binocular microscope to identify the principal minerals and rock fragments. A representative portion of each fraction having a size greater than 0.062 mm for each sample was counted on a grid until a total count of approximately 500 was reached.

SEDIMENT DESCRIPTION

Surface sediment samples were collected in 37 localities: six in Amundsen Gulf and 31 in Prince of Wales Strait. The sediment generally consisted of a reddish-brown top layer a few inches in thickness and of an underlying portion that was usually gray. In view of this, 15 samples were separated into a top and bottom

TABLE I. SEDIMENTARY PARAMETERS

*Sample**	*Location*		*Median Diam.*		*Sorting*		*Percent*			
No.	*Lat. North*	*Long. West*	*mm*	*Ø*	*Trask*	*Ø*	*Gravel*	*Sand*	*Silt*	*Clay*
1	70°45.0	127°33.2	0.043	4.65	1.02	2.25	0.20	78.2	3.7	18.0
2	70°12.7	124°35.0	0.012	6.30	4.00	2.45	0.10	37.6	45.4	16.9
3B	70°39.0	124°10.0	0.005	7.65	2.80	2.40	—	12.3	60.3	27.4
4	70°50.0	123°24.0	0.012	6.67	3.20	2.30	0.10	24.9	54.5	20.5
7	71°09.5	122°32.2	0.062	4.00	1.30	0.70	1.20	79.0	14.7	5.1
8	71°25.4	120°35.2	0.029	5.10	4.40	3.80	—	29.2	50.9	19.9
11	71°34.1	119°11.0	0.062	4.00	1.04	2.30	17.00	35.5	6.6	43.0
12	71°59.0	120°02.0	0.031	5.00	2.50	2.40	—	18.9	63.1	18.0
13	71°50.0	118°54.5	0.046	4.48	2.20	3.30	—	32.4	57.9	9.8
15	72°11.0	119°04.0	0.007	7.30	5.20	2.00	—	1.6	56.6	41.9
16	72°21.5	119°02.0	0.037	4.25	3.20	2.70	0.20	12.6	70.2	17.1
18	72°22.8	118°30.0	9.000	-3.2	30.10	5.70	0.70	7.0	32.0	60.9
19	73°12.0	115°30.0	0.034	4.80	2.30	1.60	0.40	14.2	64.3	21.1
20T	73°11.5	115°35.0	0.028	5.15	—	2.70	—	8.1	66.4	25.5
20B	73°11.5	115°35.0	0.041	4.70	1.80	1.65	0.70	54.4	32.4	12.5
21T	72°20.0	118°35.0	0.023	5.40	3.60	2.60	—	7.9	65.7	26.4
21B	72°20.0	118°35.0	0.029	5.10	2.50	1.60	0.20	48.9	38.2	12.6
22T	73°23.0	118°42.0	0.008	7.00	4.60	2.60	—	2.0	60.2	37.7
22B	73°23.0	118°42.0	0.020	5.65	2.40	1.80	0.2	36.9	52.7	10.2
23T	72°20.5	119°01.0	0.021	5.50	3.40	2.60	—	9.9	64.6	24.5
23B	72°20.5	119°01.0	0.043	4.60	2.01	1.60	0.2	61.2	31.7	6.9
24T	72°53.0	117°13.0	0.049	4.30	2.90	4.50	10.3	28.0	46.0	15.8
24B	72°53.0	117°13.0	0.079	3.90	8.60	—	26.1	55.8	13.3	4.8
25T	72°34.0	118°11.0	0.024	5.30	5.50	3.10	0.1	19.4	50.7	29.8
25B	72°34.0	118°11.0	0.053	4.25	1.60	1.25	0.3	68.6	24.7	6.4
25a	—	—	1.500	-0.5	8.70	1.60	54.5	28.4	14.2	2.9
26T	72°38.8	118°38.0	0.009	6.80	4.70	2.70	—	21.8	59.4	18.9
26B	72°38.8	118°38.0	0.035	4.80	1.30	1.00	—	75.5	13.7	10.9
27T	72°40.8	118°51.0	0.014	6.10	3.90	2.60	0.3	2.2	64.9	32.7
27B	72°40.8	118°51.0	0.020	5.70	2.10	1.25	—	36.3	52.8	10.9
28T	72°20.0	118°28.0	0.025	3.30	2.45	1.95	—	7.9	73.7	18.4
28B	72°20.0	118°28.0	0.033	4.90	1.70	1.45	0.9	51.1	37.5	10.5
29T	72°23.0	118°55.0	0.004	9.00	6.50	1.60	0.5	1.7	35.6	62.1
30T	72°22.5	119°15.0	0.023	5.45	3.40	2.80	—	8.3	66.8	24.9
30B	72°22.5	119°15.0	0.041	4.70	1.50	1.20	0.1	59.1	30.9	10.0
31T	71°56.2	120°05.0	0.007	7.10	4.50	3.00	—	3.6	65.4	31.0
32T	71°53.2	119°40.0	0.0056	7.50	3.90	2.30	—	4.7	51.8	43.6

* T = top of sample
B = bottom of sample
a = adjacent sample

TABLE I (continued)

*Sample**	*Location*		*Median Diam.*		*Sorting*		*Percent*			
No.	*Lat. North*	*Long. West*	*mm*	*Ø*	*Trask*	*Ø*	*Gravel*	*Sand*	*Silt*	*Clay*
32B	71°53.2	119°40.0	0.0063	6.85	3.20	2.20	0.1	24.9	58.1	16.9
33T	71°54.6	119°05.0	0.052	4.23	1.50	1.35	—	25.9	61.9	12.2
34T	71°37.0	119°15.0	0.230	2.10	6.70	2.70	6.8	38.7	32.7	21.8
34aB	71°37.0	119°15.0	0.125	3.00	5.50	11.50	1.5	48.4	11.5	38.6
35T	71°31.0	119°46.0	0.013	6.20	3.60	32.55	—	13.4	56.5	30.1
35B	71°31.0	119°46.0	0.026	5.30	3.30	3.00	14.3	44.6	43.9	5.2
36T	71°32.3	120°27.0	0.0114	6.40	3.70	1.60	—	7.6	61.7	30.7
37T	73°23.8	115°05.0	0.033	4.90	3.40	3.05	0.1	23.2	76.8	7.8
38T	73°20.6	115°03.0	0.037	4.75	1.80	2.50	0.8	9.8	69.6	19.8
39T	73°14.2	115°30.0	0.017	5.85	1.00	2.85	0.4	3.8	73.2	22.6
39B	73°14.2	115°30.0	0.037	4.83	2.30	1.70	—	55.1	35.1	9.8
40T	73°05.0	116°38.0	0.0135	6.15	3.60	2.60	0.1	8.0	61.5	30.5
40B	73°05.0	116°38.0	0.026	5.30	2.60	2.10	0.2	45.1	40.8	13.9
42T	73°01.0	116°28.0	0.056	4.15	3.40	4.65	13.1	32.9	40.2	13.8
42B	73°01.0	116°28.0	0.047	4.45	1.08	1.30	—	82.0	5.3	12.7
Ice Island			0.052	4.60	1.60	2.00	0.3	26.3	65.6	7.9
Ice Island			0.040	4.70	1.50	1.35	0.2	68.0	31.3	3.3

* T = top of sample
B = bottom of sample
a = adjacent sample

portion, making a total of 52 mechanical analyses. In addition, two samples from the ice island were analyzed. Table I and Fig. 2 give the location of all samples and their sedimentary parameters.

Size Distribution. The size parameters considered in this paper are: (1) median diameter, (2) modal diameter, (3) sorting, and (4) percent gravel, sand, silt, and clay. Many of the samples are bimodal, thus the median diameter may not always represent a good view of the size distribution. In some cases the median may fall in an area between the two modes where the actual percentage of that specific size is low. Also, it is difficult at times to consider a sorting factor when two modes are present. If the two modes fall between the 25 and 75 percentile (16 and 18 percentiles for Ø sorting) it is possible to have a sorting value which indicates good sorting. These difficulties invariably arise when using such parameters to describe a sedimentary deposit.

MEDIAN DIAMETER: This was calculated for all of the samples. In describing the sediments by this parameter it was found that

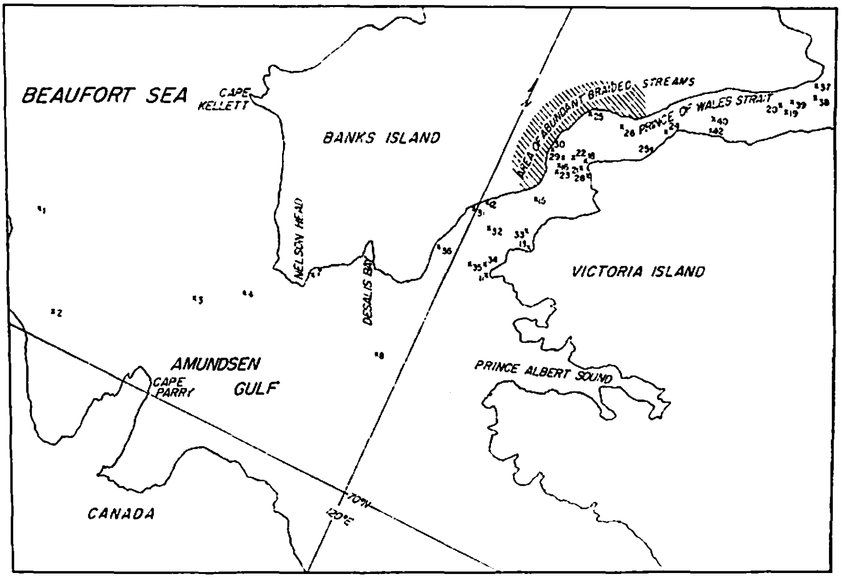

Figure 2. Map showing location of all samples.

4 °/₀ of the medians are in the category of coarse sand and larger, 4 °/₀ in both medium and fine sand ranges, 37 °/₀ in the coarse silt range, 31 °/₀ in the medium silt range, and 20 °/₀ in the fine silt. There are no medians which can be classified as clay.

By means of the median diameter, all but one sample from Amundsen Gulf can be described as silt. Sample 7, taken immediately offshore from Nelson Head, is fine sand.

Sediments from Prince of Wales Strait are also primarily silt, but those on the Banks Island side are noticeably finer than those on the Victoria side. The average median diameter of the top sediments for the Banks Island side of the center line is 0.018 mm while that for the Victoria side is 0.161 mm. The bottom portions of the samples show the same characteristic; the Banks side 0.029 mm, the Victoria side 0.047 mm.

In addition to the horizontal distribution there is also an apparent vertical change in median diameter. All but one of the 14 top and bottom pairs indicate a smaller average median diameter for the surface layer (0.022 mm) than for the subsurface layer (0.035 mm).

Modality: Although most of the modes fall in the range of fine sand to coarse silt; *i. e.*, 0.062 to 0.031 mm, there are some in the gravel and clay range. About 50 $^0/_0$ of the sediments sampled show some degree of bimodality, the other half being unimodal. The bimodals are usually either in the gravel range and fine sand or silt, or in the clay range and fine sand and silt. Fig. 3 gives some selected examples of the modal distribution.

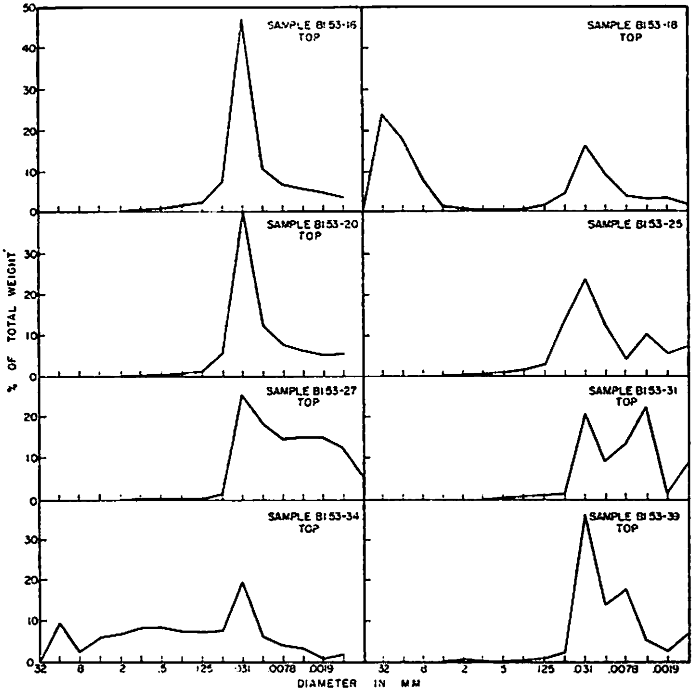

Figure 3. The modal distribution in some selected sediment samples.

It is particularly noticeable that the modes for the top samples are principally at about 0.031 mm, while those of the bottom portions are at approximately 0.062 mm. In other words, the bottom portion is consistently larger than the top part. This agrees with a similar observation with respect to the median diameter.

Sorting: According to Trask (Krumbein and Pettijohn, 1938), sediments exhibit good sorting when the value for $\sqrt{Q_3/Q_1}$ is less than 2.5, normal or fair sorting when it lies between 2.5 and 4.15, and poor sorting when it is greater than 4.5.

The sediments examined show sorting values which range from 1.0 to 30.1. Of these sediments, 37 % have good, 14 % fair, and 22 % poor sorting coefficients. Except for one sample, those from the southern third and northern third of Prince of Wales Strait have good or fair sorting while the central third have fair to poor sorting coefficients; none of the samples in the central area show good sorting.

The six samples taken in Amundsen Gulf have fair and good sorting values. Samples 1 and 7, both from shallow water, also have median diameters in the fine sand range. Samples 2, 3, 4, and 8, further from shore in deeper water, have medians in the silt range.

GRAVEL, SAND, SILT, and CLAY: Here the term gravel is used for particles larger than 2.0 mm, sand for those from 1.0 to 0.062 mm, silt for particles from 0.062 to 0.0039 mm, clay for those finer than 0.0039 mm. The gravel component ranges from 0 to 56 % of the total sample, sand from 1.6 to 82.0 %, silt from 3.7 to 76.0 %, and clay from 2.9 to 62.0 %.

The gravels are apparently concentrated on the Victoria side. Of the 12 samples with gravel concentrations of 0.5 % or more, nine are from that side, with the remaining three along the center of the Strait. There is little if any gravel found in deposits on the Banks side.

On the average, the sand concentration is also on the Victoria side, where the samples have an average of 22 % while those near Banks Island contained an average of 11 %. In contrast, samples from the Banks side consist of 63 % silt on the average while those on the Victoria side have 48 %. Though there may be wide variations in the clay fractions of discrete samples, the average is about the same for both sides of the Strait. The Banks side contains about 29 % clay and the Victoria side about 21 %. It is quite obvious from this that the portion of the Strait adjacent to Banks Island contains the smaller sizes, principally silts, while the Victoria side contains most of the sand and gravel. This observation corresponds with the distribution indicated by the median diameter.

The coarse fraction of a sample is more concentrated in the lower portion than in the upper, for in almost all instances there is less gravel in the surface sediments (1.5 %) than in the lower sections

(3.0 $^0/_0$). The sand concentration is even more striking than that of the gravel, with an average of about 12 $^0/_0$ in the top and 50 $^0/_0$ in the bottom.

Rock and Mineral Composition. Results of microscopic examinations indicate that the sediments are principally composed of quartz, limestone, sandstone, quartzite, and basic rocks (see Table II). In addition there are other minerals as well as biological material, but in general these latter two categories comprise only a small fraction of the sample. Note, therefore, that the percentages do not include the biological and minor mineral or rock fragments. The quartz content of the deposits varies from 26 to 72 $^0/_0$, limestone from 11 to 46 $^0/_0$, sandstone and quartzite from 7 to 20 $^0/_0$, and basic rocks from 6 to 25 $^0/_0$.

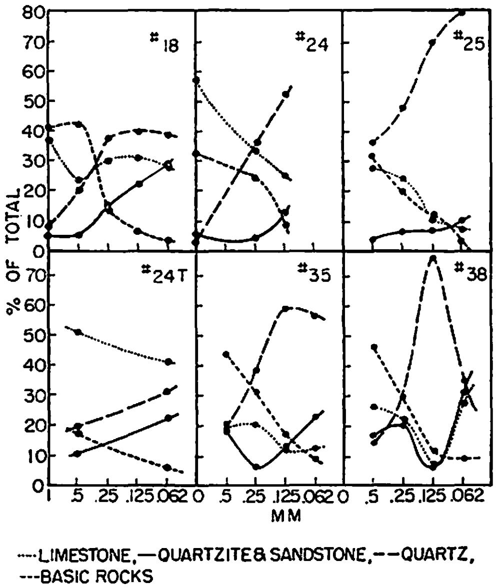

Figure 4. The rock and mineral composition of some selected sediment samples.

In keeping with the presentation of data for size distribution, Prince of Wales Strait is proportioned into two sections. Quartz comprises about 65 $^0/_0$ of the sediments on the Banks side and 39 $^0/_0$ on the Victoria side. Limestone is more noticeable in the area near Victoria Island with 24 versus 18 $^0/_0$. Sandstone and quartzite

TABLE II. RESULTS OF MICROSCOPIC EXAMINATION OF SAMPLES

Sample No.	*Size Fraction (mm)*	*Percent Composition*			
		Quartz	*Limestone*	*Sandstone, Quartzite*	*Basic Rocks*
8	.5	37	37	6	8
	.25	67	16	5	11
	.125	71	11	9	8
	.062	50	22	19	9
12	.25	63	19	9	9
	.125	62	12	15	11
	.062	69	8	15	8
13	.5	30	34	8	27
	.25	54	11	11	24
	.125	58	11	14	15
	.062	47	16	27	8
15	.25	64	13	8	14
	.125	75	8	8	9
	.062	71	14	10	5
16	.25	57	29	—	14
	.125	56	39	—	5
	.062	59	36	—	5
18	1.0	8	36	5	41
	.5	20	23	5	43
	.25	38	30	15	14
	.125	40	31	22	6
	.062	38	28	29	4
19	.25	42	35	7	16
	.125	68	11	8	12
	.062	43	29	24	4
20	.25	47	25	17	11
	.125	46	32	15	6
	.062	53	20	24	2
21	.25	51	26	14	7
	.125	42	16	25	16
	.062	45	26	21	8
22	.25	60	21	11	8
	.125	57	15	19	9
	.062	60	19	14	7

TABLE II (continued)

Sample No.	*Size Fraction (mm)*	*Percent Composition*			
		Quartz	*Limestone*	*Sandstone, Quartzite*	*Basic Rocks*
23	.25	53	23	12	11
	.125	50	21	17	12
	.062	63	15	12	9
24	1.0	4	57	6	33
	.5	—	Lost	—	—
	.25	37	34	4	25
	.125	52	26	13	9
25	.5	36	28	5	31
	.25	48	25	7	20
	.125	69	11	7	12
	.062	79	8	10	3
26	.25	34	16	8	11
	.125	51	11	18	14
	.062	80	5	7	8
28	.5	21	30	3	45
	.25	49	18	6	26
	.125	57	20	10	12
	.062	49	16	10	20
29	.25	73	19	8	8
	.125	39	19	10	20
	.062	43	18	17	22
30	.25	68	14	7	8
	.125	80	8	6	6
	.062	69	10	10	11
31	.25	71	8	9	12
	.125	64	11	16	9
	.062	59	13	21	7
32	.25	68	17	7	8
	.125	56	21	16	7
	.062	44	28	19	8
33	.25	59	20	19	2
	.125	60	11	12	17
	.062	49	12	24	15

TABLE II (continued)

Sample No.	*Size Fraction (mm)*	*Percent Composition*			
		Quartz	*Limestone*	*Sandstone, Quartzite*	*Basic Rocks*
34A	1.0	4	34	10	36
	.5	27	43	13	8
	.25	38	9	28	19
	.125	43	10	26	20
	.062	48	17	25	10
35	.5	20	19	18	43
	.25	38	20	6	31
	.125	58	12	13	17
	.062	56	13	23	8
36	.25	74	12	4	9
	.125	80	8	7	5
	.062	60	16	13	11
37	.5	13	42	—	45
	.25	46	32	—	21
	.125	60	7	4	29
	.062	39	57	—	4
38	.5	14	25	16	45
	.25	29	22	20	29
	.125	75	7	6	11
	.062	34	27	30	9
40	.25	55	13	6	26
	.125	22	22	14	22
	.062	47	28	14	11
42	1.0	1	57	6	36
	.5	21	36	28	13
	.25	42	15	4	32
	.125	40	17	10	32
	.062	57	18	17	6

appears to have about the same average distribution, with 11 and 13 $^0/_0$ respectively on the Banks and Victoria sides. The basic rocks show some differentiation in that there is an approximate 10 $^0/_0$ average for the Banks Island portion and a 20 $^0/_0$ average for the Victoria Island side.

In considering the various size fractions for the quartz content, note that in general quartz is relatively low in the coarse sand and more abundant in the fine sand. In some instances, however, it appears to be equally abundant in all size fractions, although it may drop in concentration in the fine sizes. Sandstone and quartzite often show a decrease in the fine sand sizes. Generally limestone shows a decrease in concentration as the particle size becomes smaller, and the basic rocks show a definite decrease in concentration in the smaller size fractions. Fig. 4 shows a set of selected plots of the percent composition of the various rocks and mineral components.

CONCLUSION

The sediments of Amundsen Gulf and Prince of Wales Strait appear to be principally silts mixed with varying amounts of gravels, sands, and clays. Although some of the samples indicate a predominance of sands and gravels, these may have been rafted into the area by sea ice.

The bimodality shown by about half of the samples may be the result of "dumping" of sediments that have been accumulated in or on the ice; as it melts the ice deposits the coarse sediments in an area where only fine material would usually be deposited by normal means while the fine sediment released from the ice is probably subjected to the current regime of the area.

The most probable explanation of the fair to poor sorting of sediments from the central portion of Prince of Wales Strait lies in the disposition of fine material carried by the relatively large number of streams which drain into this area from Banks Island. All of the poorly sorted samples are relatively high in silt and clay content.

The noticeable coarseness of deposits adjacent to Victoria Island in comparison with those near Banks Island may be due in part at least to currents winnowing out the fine constituents. However, current data are exceedingly sparse and not available at this time. Also it is possible that ice does much of its melting in place on the Victoria side so that any coarse ice-rafted load would then be deposited there.

The bottom portion of sediment samples was almost invariably coarser than the portion at the very surface. It is difficult to postulate a very recent change in the depositional environment as there is no additional evidence to support this contention. However, when one considers the fluidity of surface sediments versus that of deeper deposits then it is quite possible that the coarse material has been incorporated into the previously deposited sediments by the action of currents or by settling. This is an important consideration in any sedimentary investigation. If such were the case then observations concerning deposits are not necessarily in accord with the time factor involved in the deposition of the particles.

The minerals and rocks appear to be derived dominantly from sedimentary and basic igneous rocks, which is in contrast to sediments from the Beaufort and Chukchi seas. The quartz content of sediments in Amundsen Gulf and Prince of Wales Strait may have come from sedimentary or acid igneous rocks.

The decrease in basic igneous rocks with particle size is quite normal and should be expected, since these rocks and their associated minerals generally would be less resistant to weathering than would the quartz fraction. Likewise the limestone, which is detrital in nature, should decrease in concentration with decreasing size. On the other hand, sandstone, quartzite, and quartz, being more resistant to weathering, should normally show a relative increase in concentration with a decrease in size.

The predominance of basic igneous rocks adjacent to Victoria Island may be explained by two lines of reasoning. Possibly there is a greater supply of basic material on the Strait shore of Victoria Island than on the Banks shore. But it is also quite possible that the ice which holds the basic rocks as well as other materials melts in place more profusely along the Victoria shore than along the Banks shore. Thus ice adjacent to Banks Island may well be carried away by currents. This latter possibility accords better with our observations than the former possibility.

Ice on the sea surface makes this or any other region a complex area to study. Though wave or tidal action is relatively negligible, the presence of the ice in itself increases the complexity of the situation. While sedimentation occurs in what might be considered more normal ways in most other marine areas of the world, it is greatly modified in Arctic regions due to ice-rafting. As a case in point, we may note the ice islands observed in Prince of Wales Strait. Presumably these originated from the shelf ice at Ellesmere Island over 1000 miles away and evidently drifted in from the vast permanent Arctic ice pack to become grounded in the Strait.

ACKNOWLEDGMENTS

The writers wish to thank Drs. C. Barnes and T. G. Thompson for their interest in having a sedimentary program incorporated in the Beaufort Sea Expedition of 1953. Dr. W. Cameron, chief scientist of the expedition, and Mr. John Lincoln materially aided with help and suggestions during the sampling program. Col. J. O. Fletcher was a constant source of information concerning the Arctic and gave the senior author an opportunity to participate in shore parties that permitted first-hand observations of the regional geology. Acknowledgments are also due Commander Mahr of the U. S. S. BURTON ISLAND and his officers and men. Mr. David B. Fagg and Mr. Thomas Morris, both of the A. & M. College of Texas, assisted in sample analyses.

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