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Coastlines of the Eastern Arctic

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ABSTRACT. A computer approach was developed and used to analyse the characteristics of coastlines present in the eastern Arctic. Results of this analysis indicate that: 1) almost 75% of all coastlines include a beach; 2) backshores are mostly steep and made up of bedrock; 3) beaches are made up mostly of coarse sediments; 4) the two most abundant types of coastal zones consist of steep rocky backshores without beach, and steep rocky backshores with colluvium and continuous boulder beaches; 5) the average slope of backshores and the size of the dominant beach sediment decrease towards the north; 6) fetch has little influence on coastal characteristics; and 7) coastal characteristics are determined primarily by the physiography of the adjacent land and by the nature of backshores.

Key words: eastern Arctic, coastlines, geomorphology

RÉSUMÉ. Un programme d'ordinateur a été développé et utilisé pour l'analyse des caractéristiques côtières de l'Arctique de l'est. Il en ressort que: 1) près de 75% des côtes comprennent des plages; 2) les arrière-plages sont souvent escarpées et rocheuses; 3) les plages sont souvent composées de sédiments grossiers (blocaux et gravier); 4) les deux types de côte les plus communs sont: un littoral escarpé et rocheux sans plage; et une arrière-plage escarpée et rocheuse avec colluvions et avec plages à blocaux; 5) la pente moyenne des arrière-plages et la taille moyenne des sédiments des plages décroissent vers le nord; 6) la dimension des aires génératrices de vagues ne semble pas influencer les caractéristiques des côtes; et 7) dans l'Arctique de l'est, la nature des côtes est déterminée surtout par la physiographie de la région environnante.

Mots clés: l'Arctique de l'est, côtes, géomorphologie

Traduit par l'auteur.

INTRODUCTION

Part of the Eastern Arctic Marine Environmental Studies consisted in a survey of the coastal morphology and sedimentology of eastern Lancaster Sound and western Baffin Bay. This survey involved mapping the characteristics of coastlines of the eastern Arctic.

All mapping systems developed for this purpose share a common feature: they all produce large quantities of data that are difficult to evaluate objectively. To avoid this problem, a computer method was developed and used to analyse the characteristics of coastlines of the eastern Arctic. Besides yielding quantitative results, the methods provides a means of testing for the presence of relationships between coastal characteristics and a number of other parameters.

REGIONAL SETTING

The study area includes southeastern Devon Island, eastern Brodeur Peninsula, Borden Peninsula, Bylot Island and eastern Baffin Island (Fig. 1).

The physiography of the area (Fig. 2) reflects mostly differences in bedrock lithology and structure. The eastern regions of Devon Island, and most of Bylot and Baffin islands, are composed of Precambrian igneous and metamorphic rocks and have a rugged topography. The western part of Devon Island, Brodeur Peninsula, and Borden Peninsula are underlain by thick, horizontal or nearly horizontal Paleozoic strata and are characterized by a plateau topography.

Coastal Lowlands of Bylot and Baffin Islands (Fig. 2, Unit I)

The periphery of western and northern Bylot Island consists of sedimentary rocks. On the southwestern corner of the island, a well-developed lowland slopes from the base of the mountains to sand and gravel beaches backed by low coastal bluffs, marine terraces and raised beaches. The northeastern part of the island is also occupied by a lowland. There, except for three headlands of diabase, the coastline consists mostly of gravel beaches, often backed by low eroding bluffs.

Eight distinct coastal lowlands occur on Baffin Island (Fig. 3). Except for the northernmost one, they are underlain by the same crystalline rocks that form the adjacent highlands and all have a low relief. Their drift surface is interrupted locally by low protruding hills of bedrock. Because of their low relief, drainage is often poorly organized and small lakes, marshes and swamps occur frequently. Low bedrock headlands, low cliffs of till or marine sediments with narrow beaches, sand beaches, and extensive tidal sand flats border the lowlands.

Davis Highlands (Fig. 2, Unit II)

This physiographic division forms a discontinuous, elevated belt of deeply dissected igneous and metamorphic rocks that extends along the eastern parts of Ellesmere, Devon, and Baffin islands and covers most of Bylot Island.

Eastern Devon Island is largely covered by ice and from a distance, it appears as a steep-sided, flat-topped dome. Along the southern coast cliffs reach elevations of about 900 m usually within a few km of the shore. Four valley glaciers associated with extensive lateral and medial moraines descend from the ice cap and actively discharge into Lancaster Sound. Beaches are often discontinuous and made up of gravel and sand, except on Philpots Island where boulder beaches predominate.

Most of Bylot Island is occupied by the ice-covered Byam Martin Mountains from which numerous glaciers

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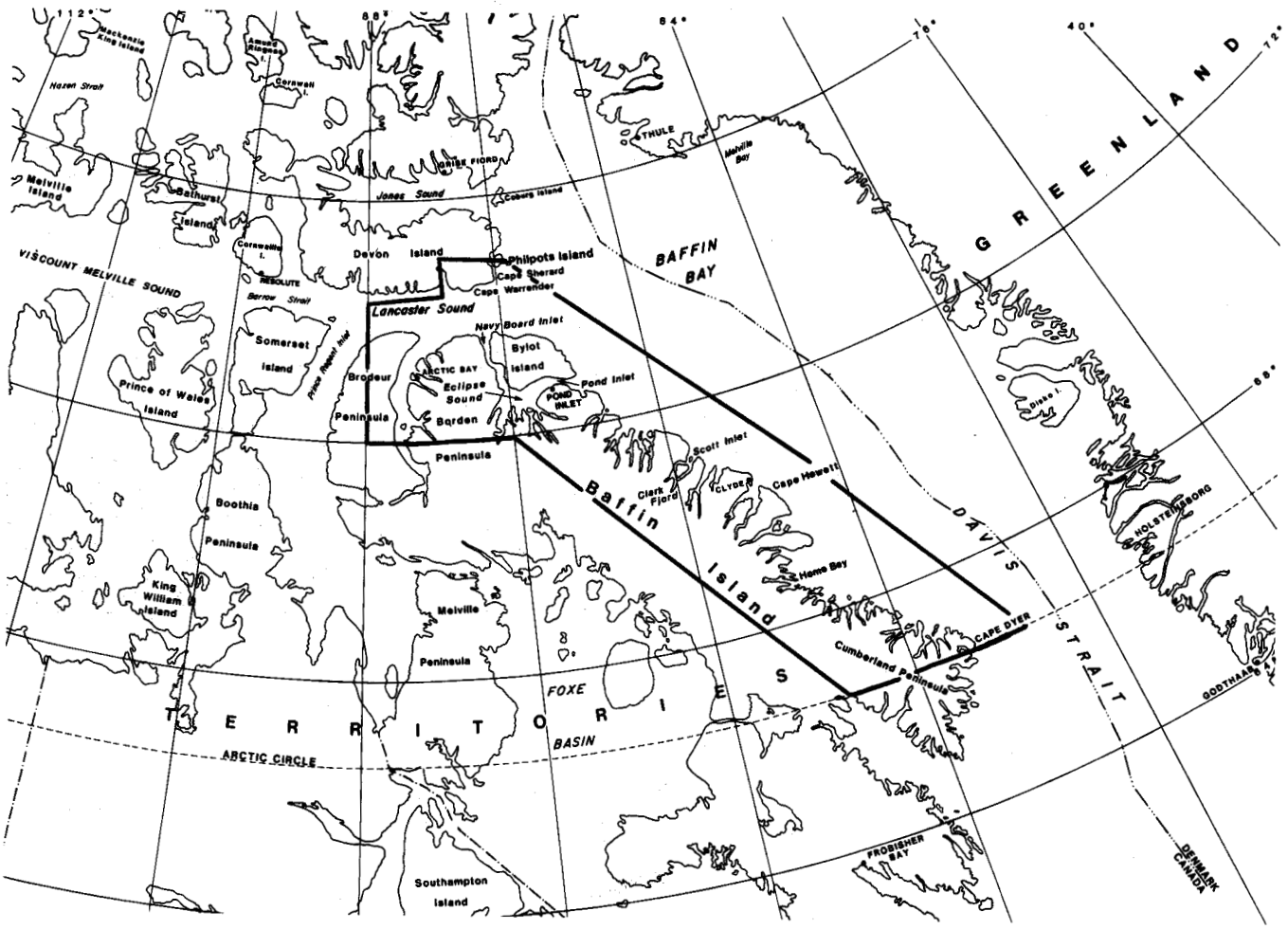


FIG. 1. Location of the study area.

flow outward and occasionally reach the sea (Fig. 4). Bedrock outcrops locally from the ice as sharp nunataks, arêtes, cols, tors, and cirques, and peaks reach altitudes of 1500 to 1800 m. Along the southeastern part of the island, the coast is generally steep except where interrupted by broad glacial valleys. These terminate in extensive outwash plains.

On eastern Baffin Island, the Davis Highlands form a belt of mountains and plateaus penetrated by numerous vertically-walled fiords. Many peaks attain elevations of 2000 m and the mountains include substantial areas of permanent ice. Glaciers occasionally reach sea level and extensive valley systems are present, sometimes partly filled with lobes of ice. Coastlines are generally steep and rocky, and with or without colluvial debris and continuous boulder and gravel beaches.

Lancaster Plateau (Fig. 2, Unit III)

This physiographic division covers the western part of Devon Island, and the Brodeur and Borden peninsulas.

On Devon Island, this division is characterized by a dissected plateau surface which terminates into a coastal plain of variable width.

On Brodeur Peninsula, the general elevation of the plateau is about 400 m and dissection is limited to its perimeter. In the north and east, the gently undulating plateau surface reaches the sea either in spectacular cliffs or through a narrow coastal plain.

Northern Borden Peninsula is a plateau dissected by major valleys, separated from Lancaster Sound by a broad coastal plain. This plain terminates seaward in a series of low cliffs and bluffs interrupted by deeply entrenched river valleys.

The shores of Navy Board Inlet consist mostly in sand and gravel beaches, sometimes backed by low bluffs or raised beaches.

The southwestern part of Eclipse Sound (Fig. 5) includes a number of steep-sided bays, inlets and sounds, with small lowlands restricted to their heads. Beaches, when present, either are continuous or occur in pockets between headlands.

Baffin Upland (Fig. 2, Unit IV)

This physiographic division consists of plateaus and hills of uniform topography. It extends northwest to southeast through central Baffin Island. Within the study area, this division includes relatively few coastlines.

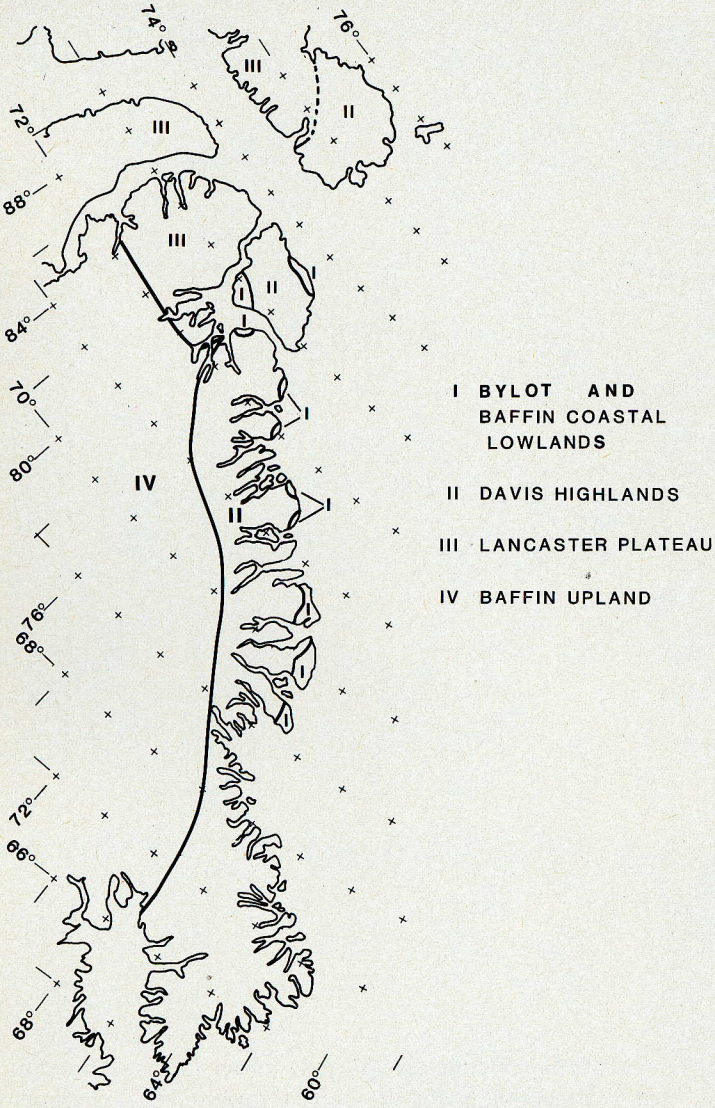


FIG. 2. Physiographic divisions of the eastern Arctic (after Bostock, 1970; and McGill University, 1963 a, b, c).

FIG. 3. Continuous sand beach with a gently sloping unconsolidated backshore on the northeastern shore of Scott Inlet. The southern extremity of the Adair Lowland, one of eight distinct coastal lowlands that occur on eastern Baffin Island, makes up the foreground. Part of the Davis Highlands is visible in the background. View to the southwest from 71° 14′ N, 71° 11′ W, 16 September 1978.

FIG. 4. Most of the Byam Martin Mountains on Bylot Island are ice-covered and numerous valley glaciers flow outward, occasionally to the sea. View to the southwest from 73° 26′ N, 77° 20′ W, 12 August 1979.

FIG. 5. South of Eclipse Sound, the Lancaster Plateau consists in a series of steep-sided bays and inlets. View to the south from 72° 26′ N, 79° 38′ W, 11 June 1980.

METHODS

Coastlines of the study area were mapped using a system developed at the Geological Survey of Canada (McLaren, 1980).

This system describes coastal zones using the following symbols:

1) s, m or 1 to denote the slope of the backshore (s = steep 45° - 90°, m = moderate 15° - 45°, 1 = low 0° - 15°);

2) R or U to denote the nature of the backshore (R = bedrock, U = unconsolidated);
3) (c) to denote the presence of substantial colluvial debris;
4) :, -, / to indicate the amount of beach in coastal zones (: = more than 80%, - = 20% to 80%, / = less than 20%);
5) c, p, b to denote the type of beach present (c = continuous, p = pocket, b = barrier);
6) B for beach;
7) b, g, s, *s* to denote the dominant beach sediment size (b = boulder, g = gravel, s = sand, *s* = silt). Glacial ice, when present, is denoted by GI.

For example, sR denotes a steep rocky backshore without beach, sR(c):cBb denotes a steep rocky backshore with colluvial debris and more than 80% of continuous boulder beach, and 1U-bBs denotes a gently sloping unconsolidated backshore with 20 to 80% of barrier beach made up of sand.

The mapping itself was based on the interpretation of high altitude vertical and low altitude oblique photographs and extensive field work (McLaren *et al.*, 1981). Results were displayed at a scale of 1:125 000.

In order to analyse the coastal data by computer, parameters describing each map unit were encoded along with the length of the unit, its geographical position in terms of latitude, its associated fetch and a symbol denoting the physiographic division in which it occurs.

RESULTS AND DISCUSSION

Coastal Characteristics

The study area includes 11 708 km of coastlines and, according to the mapping system used, 94 distinct types of coastal zones (Table 1). Almost 75% of all coastlines include beaches and less than 1% consist of glacial ice. Backshores, as defined by King (1972), are mostly steep and made up of bedrock. Backshores made up of bedrock with colluvium occur almost as frequently as those made up of unconsolidated sediments. Beaches, when present, are most often continuous and made up of coarse (boulder and gravel) sediments.

Geographical Distribution of Coastal Characteristics

The coastal characteristics described above refer to the overall study area. Variations of characteristics within the study area can be detected by grouping coastlines according to increments of one degree of latitude and by comparing graphically the characteristics of each group (Fig. 6).

Within the study area, glacial ice makes up a significant proportion of coastlines only in the northernmost part. North of 73°N, backshores often slope gently and are often made up of unconsolidated sediments; south of 73°N, they are mostly steep and made up of bedrock. Although beaches are generally present throughout the area, they occur most frequently between 72° and 73°N (northeastern Baffin Island) and least frequently between 68° and 69°N (Home Bay). Continuous beaches are present throughout the area; pocket beaches (small, crescentic beaches often bounded by rocky headlands) occur mostly north of 72°N and south of 69°N; and barrier beaches (elongated, narrow beaches extending parallel to the shore and enclosing a lagoon) occur mostly north of 73°N. Coarse sediments (boulders and gravel) predominate in beaches throughout the area and finer sediments (sand and silt) occur mostly in beaches located between 69° and 73°N.

Coastal Zones

In the eastern Arctic, the five most important types of coastal zones, ranked in order of decreasing abundance, are:

1) steep rocky backshore without beach (22.5%; 2634 km) (Fig. 7);
2) steep rocky backshore with colluvium and a continuous boulder beach (18.4%; 2154 km);
3) steep rocky backshore with a continuous boulder beach (5.4%; 632 km) (Fig. 8);
4) moderately sloping unconsolidated backshore with a continuous gravel beach (5.2%; 608 km); and
5) gently sloping unconsolidated backshore with a continuous gravel beach (4.6%; 538 km) (Fig. 9).

Together these five most abundant coastal zones make up 56.1% (6568 km) of all coastlines. The remaining 43.9% (5140 km) includes 89 other types of coastal zones. Figures 10, 11, and 12 illustrate glacial ice, and pocket and barrier beaches.

TABLE 1. General coastal characteristics of the eastern Arctic

Length of coastline (km)		11708
Number of Map Units		2569
Number of Coastal Zones		94
Coastline:	Beach Absent	26.1%
	Beach Present	73.3%
	Glacial Ice	0.6%
Backshore Slope:	Steep	60.7%
	Moderate	25.2%
	Low	13.5%
Backshore Material:	Bedrock	56.3%
	Bedrock with Colluvium	20.8%
	Unconsolidated	22.2%
	Unconsolidated with Colluvium	0.1%
Amounts of Beach in Map Unit:	More than 80%	55.5%
	20-80%	9.5%
	Less than 20%	8.3%
Types of Beach:	Continuous	64.5%
	Pocket	8.1%
	Barrier	0.7%
Dominant Beach Sediment:	Boulder	34.5%
	Gravel	28.2%
	Sand	10.3%
	Silt	0.3%

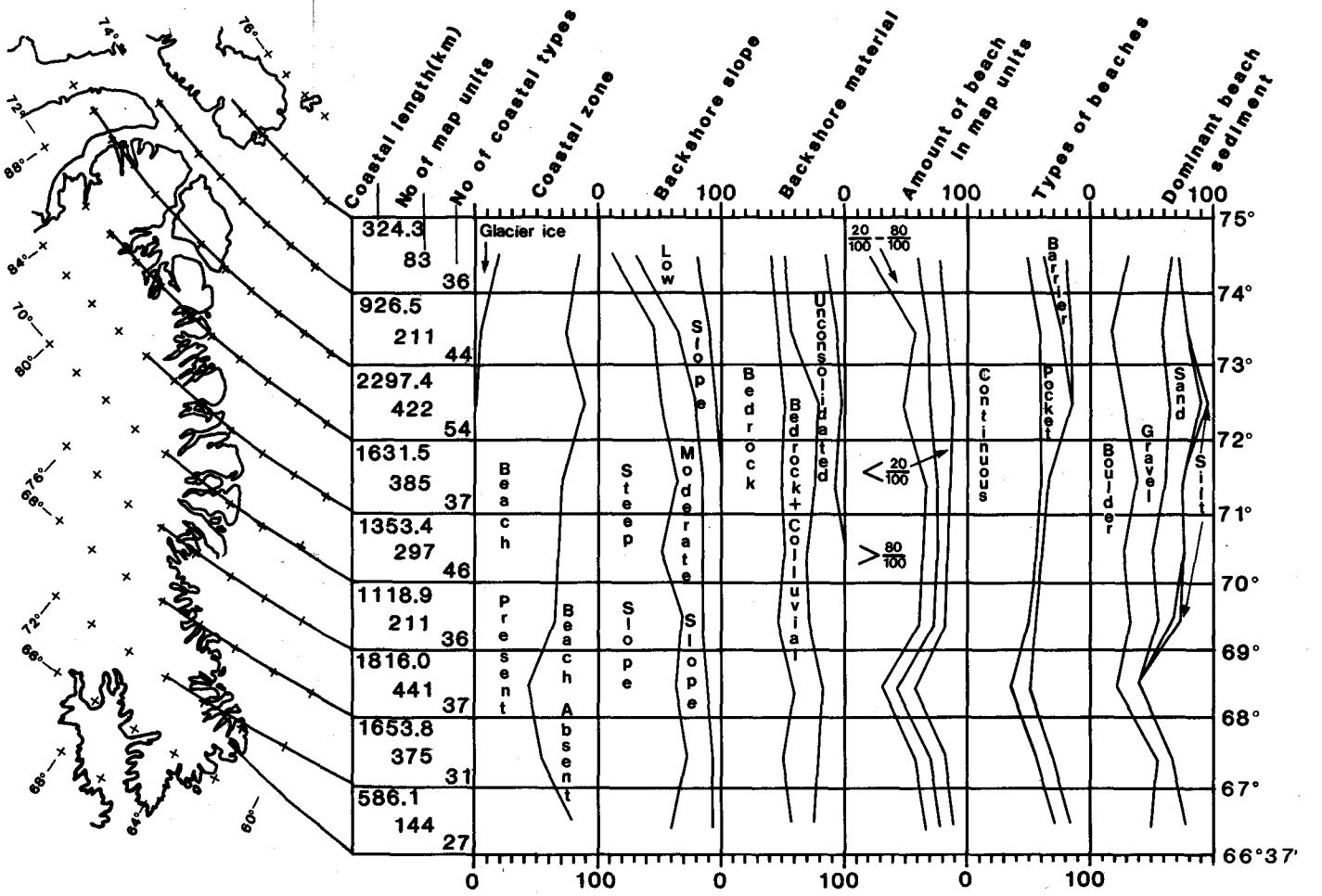


FIG. 6. Variations of coastal characteristics according to latitude.

Data on coastal characteristics and coastal zones may appear, at first, to be contradictory and it is important to understand why this is so. For example, one general coastal characteristic of the eastern Arctic is the abundance of beaches. Yet the single most abundant type of coastal zone consists in a steep, rocky backshore without beach. Both statements are true and the apparent contradiction disappears when one realizes that this type of coastal zone makes up only 22.5% of all coastlines. The remaining 77.5% includes 93 other types of coastal zones, of which most include a beach.

Geographical Distribution of Coastal Zones

Variations in types of zones within the study area can be detected by grouping coastal data according to increments of one degree of latitude and by comparing the dominant zones of each group (Table 2).

On southeastern Devon Island, between Croker Bay and Philpots Island (Table 2, line 1), the five most dominant coastal zones are:

1) gently sloping unconsolidated backshore with a continuous gravel beach (51 km);
2) glacial ice (40 km);
3) steep rocky backshore without beach (19 km);
4) moderately sloping unconsolidated backshore with a continuous gravel beach (18 km); and
5) steep rocky backshore with colluvium and a continuous boulder beach (15 km).

Together these five zones occupy 43.7% (143 km) of all coastlines of the area and the remaining 56.3% (181 km) includes 31 other types of coastal zones.

South of 74°N to Cape Dyer, the dominant type of coastal zone changes to a steep rocky backshore, with or without colluvium and with or without a continuous boulder beach. In the area of Home Bay between 68° and 69°N (Table 2, line 7), the dominant coastal zone, a steep rocky backshore without beach makes up, by itself, 45.6% of all coastlines.

The combined abundance of the five predominant types of coastal zones (Table 2, column 6) is a reflection of the importance of these five types in the area under consideration. For example, between 72° and 73°N, the five most abundant types of coastal zones make up only 39.1% of all coastlines. In the area of Home Bay, between 68° and 69°N, they make up 78.1% of all coastlines.

The overall diversity of zones in the area under consideration is reflected by the number of remaining types

FIG. 7. The most abundant type of coastal zone in the eastern Arctic consists in a steep rocky backshore without beach. Photo taken at 74° 28′ N, 81° 38′ W, on 21 July 1979.

FIG. 8. Steep rocky backshore with a continuous boulder beach south of Clark Fiord. View to the east from 71° 02′ N, 71° 30′ W, 18 September 1978.

FIG. 9. Long, continuous gravel beaches with gently sloping unconsolidated backshores occur on northeastern Bylot Island where lowlands border the Byam Martin Mountains. View to the southeast from 73° 35′ N, 77° 30′ W, 14 August 1979.

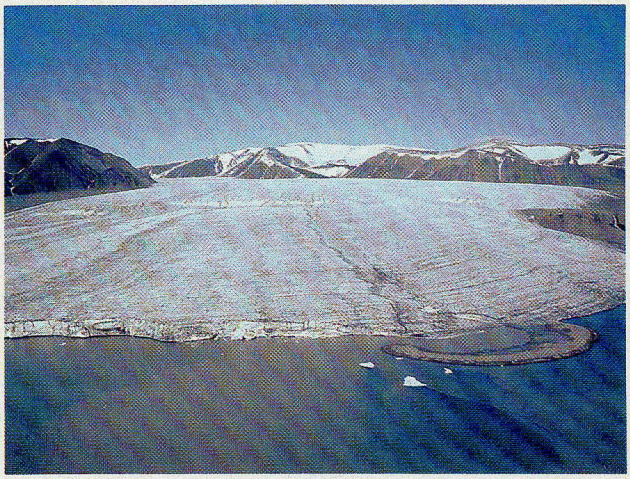


FIG. 10. Glacial ice makes up a significant proportion of the coastlines of eastern Devon Island. View to the north from 74° 30′ N, 81° 10′ W, 21 July 1979.

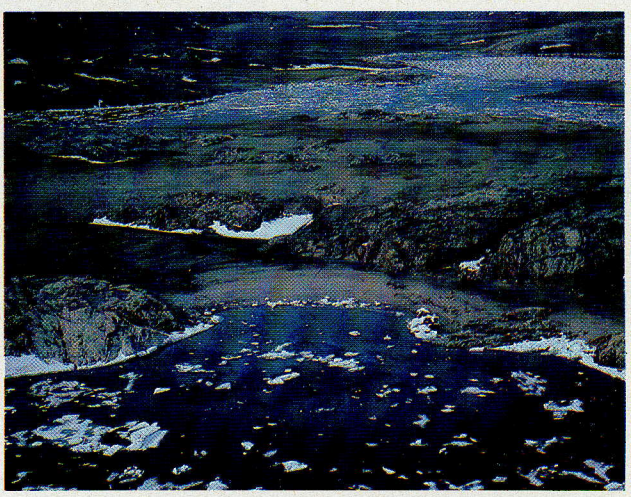
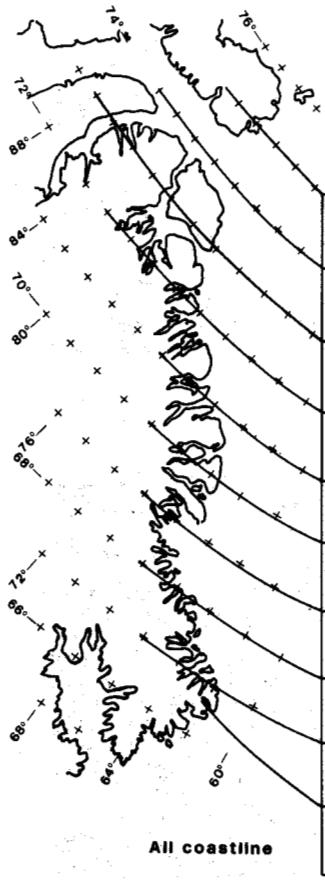


FIG. 11. Pocket beaches (small crescentic beaches often bounded by rocky headlands) occur frequently throughout the eastern Arctic. View to the west from 72° 29′ N, 79° 45′ W, 11 August 1980.

FIG. 12. In the eastern Arctic, barrier beaches (elongated narrow beaches extending parallel to the shore and enclosing a lagoon) occur most frequently north of 73°N. View to the west from 73° 22′ N, 76° 53′ W, 12 August 1979.

TABLE 2. Variations of types of predominant coastal zones in the eastern Arctic (see text for explanation of symbols)



TYPES OF COASTAL ZONES					Combined abundance	Number of remaining types of coastal zones	
IU:cBg 15.7%	GI 12.2%	sR 5.8%	mU:cBg 5.5%	sR(c):cBb 4.5%	43.7%	31	75°
sR 16.8%	IU:cBg 16.0%	sR:cBb 7.7%	sR:cBg 6.6%	sR(c):cBg 5.6%	52.7%	39	74°
sR(c):cBb 10.3%	sR:cBb 9.6%	sR 7.0%	sR-cBb 6.5%	mR:cBg 5.7%	39.1%	49	73°
sR(c):cBb 27.5%	sR 23.5%	sR:cBg 8.0%	IU:cBs 8.0%	sR:cBb 6.6%	73.6%	32	72°
sR 25.3%	sR(c):cBb 21.7%	mU:cBg 11.5%	IU:cBs 10.4%	mR:cBg 3.6%	72.5%	41	71°
sR 31.0%	sR(c):cBb 27.5%	mU:cBg 10.3%	IU:cBg 4.5%	mR:cBg 2.7%	76.0%	31	70°
sR 45.6%	sR(c):cBb 13.9%	mR/pBg 7.4%	mR 7.2%	mU:cBg 4.0%	78.1%	32	69°
sR(c):cBb 27.2%	sR 21.1%	mU:cBb 9.1%	sR:cBb 6.8%	mR:cBb 5.9%	70.1%	26	68°
sR(c):cBb 16.7%	sR:cBb 14.1%	sR 8.3%	mR:cBb 8.0%	mU:cBg 5.9%	53.0%	22	67°
sR 22.5%	sR(c):cBb 18.4%	sR:cBb 5.4%	mU:cBg 5.2%	IU:cBg 4.6%	56.1%	89	66° 3

(Table 2, column 7). In the eastern Arctic, the diversity of coastal zones is greatest between 70° and 71°N and least between 67°N and Cape Dyer.

Influence of Fetch and Coastal Characteristics and Coastal Zones

Fetch, the length of open water over which the wind can blow, is an important factor in the generation of waves. This distance limits the time during which energy can be transferred from wind to waves (Komar, 1976) and consequently is a parameter that limits the maximum energy level at the shoreline (King, 1972). The energy level at the shoreline is in turn a primary factor in littoral processes and its effects have been well documented by site-specific studies (Owens, 1975; McCann and Owens, 1969; Novak, 1972; Short *et al.*, 1974).

If fetch-controlled littoral processes are primary factors in the development of coastal features in the eastern Arctic, then an analysis of regional coastal data should reveal some degree of correlation between fetch and coastal characteristics or coastal zones.

Such an analysis can be done by grouping coastlines according to categories of associated fetch (Fig. 13) and by comparing the characteristics and zones of each group. In this example three categories of fetch were used, namely >100 km, 10-100 km, and <10 km.

The analysis of coastal characteristics and coastal zones grouped according to the above categories of fetch shows no well-defined trend (Table 3a). Coastlines with and without beach occur almost equally frequently within the three categories. There appears to be no relationship between fetch and types of beach sediment. Similarly, the five most abundant types of coastal zones within each category of fetch show no great difference among groups (Table 3b).

The lack of influence of fetch on coastal characteristics is also supported by the fact that the length of the open-water season varies between approximately 40 and 80 days and that littoral processes can only operate when both the sea and the beach are free of ice. Furthermore, in many places, an ice foot forms before freeze-up and persists after breakup, and consequently the length of time during which the shore is free of ice is less than that of the open-water period.

Influence of Physiography on Coastal Characteristics and Coastal Zones

If coastal characteristics and zones are not largely determined, at a regional scale, by the energy level in the littoral

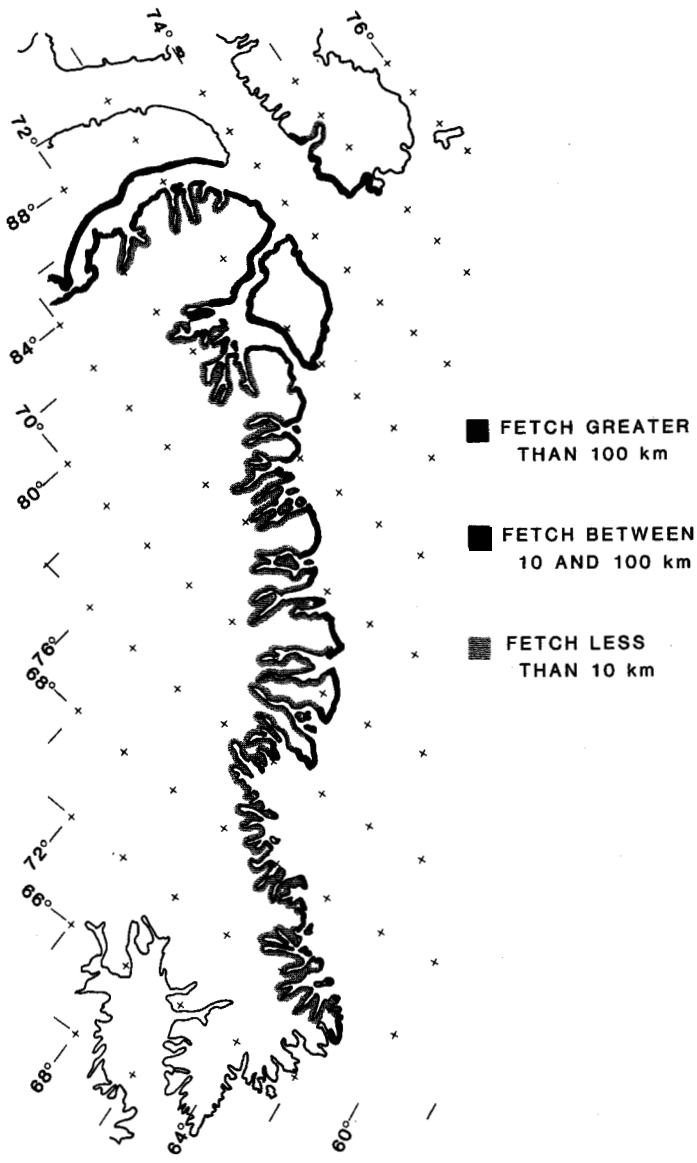


FIG. 13. Subdivision of coastlines of the eastern Arctic according to fetch.

environment, then to what factor do they owe their origin? Could the nature of the land itself be responsible for these characteristics? If this is so, then there should be some correlation between physiography and coastal characteristics. This hypothesis can be tested by grouping coastal data according to the major physiographic divisions present in the study area (Fig. 2) and by comparing the characteristics and zones of each group (Tables 4a and 4b).

Although the study area includes four major physiographic divisions, it comprises only 138 km of coastlines of the Baffin Upland. Compared to the length of coastlines mapped in the Baffin Coastal Lowlands, the Davis Highlands and the Lancaster Plateau, this is an inadequate sample; consequently that division is deleted from Tables 4a and b.

TABLE 3a. Characteristics of coastlines present in the eastern Arctic and grouped according to fetch

Fetch		<10 km	10 to 100 km	>100 km
Length of Coastline (km)		8416.3	1464.0	1827.6
Number of Map Units		1892	293	384
Number of Coastal Zones		73	49	57
Coastline:	Beach Absent	27.2%	12.1%	33.6%
	Beach Present	72.4%	87.1%	64.8%
	Glacial Ice	0.4%	0.8%	1.6%
Types of Beach:	Continuous	65.9%	71.6%	58.9%
	Pocket	6.5%	14.9%	5.9%
	Barrier	0.0%	0.6%	0.0%
Dominant Beach Sediment:	Boulder	41.3%	11.6%	27.3%
	Gravel	25.0%	54.1%	25.2%
	Sand	5.9%	21.4%	11.6%
	Silt	0.2%	0.0%	0.7%

TABLE 3b. The five predominant types of zones of all coastlines grouped according to fetch (see text for explanation of symbols)

Fetch					
<10 km		10 to 100 km		>100 km	
sR	24.2%	1U:cBg	15.2%	sR	25.1%
sR(c):cBb	23.0%	sR	9.5%	sR(c):cBb	11.4%
sR:cBb	5.3%	1U:cBs	9.5%	1U:cBs	11.0%
mU:cBg	5.3%	sR:cBb	9.1%	1U:cBg	4.9%
mR:cBg	3.6%	mU:cBg	6.6%	sU:cBs	3.7%

The analysis indicates that there is a relationship between physiographic divisions and slope and nature of backshores (Table 4a). In the Baffin Coastal Lowlands, backshores are mostly gently sloping and consist of unconsolidated sediments. In the Davis Highlands, they are mostly steep and consist of bedrock either alone or with colluvium. In the Lancaster Plateau, backshores have slopes that are either steep, moderate, or gentle, and consist of bedrock or unconsolidated sediments.

There is also a relationship between physiographic regions and beach characteristics. In the Baffin Coastal Lowlands, beaches are generally present, continuous, and made up of sand and gravel. In the Davis Highlands, beaches are less often present. When they are present, they are mostly continuous and made up of boulders and gravel. In the Lancaster Plateau, beaches are generally present, continuous, and comprised of gravel, sand or boulders.

Dominant types of coastal zones are also influenced by the nature of the land in which they occur (Table 4b). In the Baffin Coastal Lowlands, by far the most abundant

TABLE 4a. Characteristics of coastlines present in the eastern Arctic and grouped according to physiographic divisions

		Baffin Coastal Lowlands	Davis Highlands	Lancaster Plateau
Length of Coastline (km)		675.3	8664.3	2230.2
Number of Map Units		105	1995	436
Coastline:	Beach Absent	19.7%	31.1%	8.7%
	Beach Present	80.3%	68.2%	90.9%
	Glacial Ice	0.0%	0.7%	0.4%
Backshore Slope:	Steep	11.0%	66.7%	45.4%
	Moderate	21.3%	23.6%	30.3%
	Low	67.7%	9.0%	23.9%
Backshore Material:	Bedrock	11.0%	57.2%	49.3%
	Bedrock with Colluvium	9.6%	24.5%	11.1%
	Unconsolidated	79.4%	17.4%	39.1%
	Unconsolidated with Colluvium	0.0%	0.2%	0.1%
Types of Beach:	Continuous	77.7%	61.4%	73.2%
	Pocket	2.6%	6.0%	17.6%
	Barrier	0.0%	0.8%	0.1%
Dominant Beach Sediment:	Boulder	10.7%	51.3%	13.6%
	Gravel	23.4%	12.8%	57.3%
	Sand	44.3%	4.1%	19.2%
	Silt	1.9%	0.0%	0.8%

TABLE 4b. The five most abundant types of coastal zones in three physiographic divisions of the eastern Arctic (see text for explanation of symbols)

Baffin Coastal Lowlands		Davis Highlands		Lancaster Plateau	
1U:cBs	39.4%	sR	27.4%	1U:cBg	10.7%
sU:cBs	8.3%	sR(c):cBb	22.6%	sR:cBb	9.2%
mU:cBg	8.0%	sR-cBb	5.2%	mR:cBg	6.8%
sR(c):cBb	2.5%	mU:cBg	3.3%	sR(c):cBb	6.3%
sR	2.0%	1U:cBg	2.8%	1U:cBs	5.8%

type of coastal zone consists of a gently sloping unconsolidated backshore with a continuous sand beach. The three most abundant types of coastal zones include unconsolidated backshores and continuous sand or gravel beaches. In the Davis Highlands, the three most abundant types of coastal zones have steep rocky backshores with or without colluvium, and with or without a continuous boulder beach. In the Lancaster Plateau, the five predominant types of coastal zones are much more equally abundant and range from gently sloping unconsolidated backshores with continuous gravel or sand beaches to steeply or moderately sloping rocky backshores, sometimes with colluvium, and with a continuous boulder or gravel beach.

Influence of Backshores on Beach Sediments

Using the coastal data from the complete study area, it is possible to find out how backshores and beach sediments associate at a regional scale (Table 5).

In the eastern Arctic, steep rocky backshores are associated mostly with boulder beaches, moderately sloping rocky backshores with gravel and boulder beaches, and gently sloping rocky backshores with gravel or sand beaches. Steep unconsolidated backshores show little preference among sand, gravel or boulder beaches, moderately sloping unconsolidated ones are associated with gravel and boulder beaches, and gently sloping unconsolidated ones with gravel and sand beaches.

CONCLUSIONS

A quantitative evaluation of regional coastal data is, because of the nature of the data, a very tedious problem. However, simple computer methods can be used to provide answers of interest to geomorphologists and for coastal contingency planning purposes. The rapidity and ease with which data can be analysed by computers enable one to investigate different aspects of the problem, and gain a better understanding of overall coastal characteristics and their geographical variations. The influence that factors such as energy level of the littoral environment, physiography of the adjacent land, and nature of backshores exert on coastal characteristics can also be determined.

Coastlines of the eastern Arctic are characterized by the abundance of steep rocky backshores and continuous boulder beaches. Both the average slopes of backshores and average beach sediment size increase towards the south. The two most abundant types of coastal zones are steep rocky backshores without beaches and steep rocky backshores with colluvium and with a continuous boulder beach. In the northernmost part of the study area, coastal zones are substantially different: they consist of gently sloping

TABLE 5. Relative abundance of boulders, gravel, sand, and silt in beaches associated with steep, moderately sloping, gently sloping, rocky and unconsolidated backshores

Backshore Slope and Material	Dominant Sediment Size			
	Boulder	Gravel	Sand	Silt
Steeply Sloping Rocky	76.2%	18.2%	5.6%	0.0%
Moderately Sloping Rocky	22.4%	64.8%	12.8%	0.0%
Gently Sloping Rocky	16.0%	62.8%	21.2%	0.0%
Gently Sloping Unconsolidated	4.5%	47.9%	45.6%	2.0%
Moderately Sloping Unconsolidated	34.4%	52.7%	12.3%	0.6%
Steeply Sloping Unconsolidated	29.6%	35.0%	35.4%	0.0%

unconsolidated backshores with continuous gravel beaches and glacial ice. Fetch appears to have little influence, at a regional scale, on coastal characteristics and types of coastal zones. In the eastern Arctic, coastal characteristics are governed primarily by the physiography of the adjacent land and by the nature of backshores.

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