UNITED STATES DEPARTMENT OF THE INTERIOR
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MAP SHOWING COASTAL MORPHOLOGY OF THE NORTHERN BERING SEA COAST OF ALASKA

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EXPLANATION

The enclosed map describes the coastal morphology of the northern Bering Sea coast of Alaska from the Yukon Delta to the Bering Strait. The descriptions are based on groupings of physiographic features found within a given segment of coast. Features found within the study area include tidal flats, beaches, barrier spits and islands, beach ridges (found singly and in complexes), erosional outcrops on beaches, and bluffs or cliffs. Symbols used to represent each feature are defined on the map and in more detail in Table 1. For a given segment of coast, symbols are arranged in a sequence so that the physiographic feature closest to the low-tide line is described first (at the left) with landward features following in sequence. For example, the symbol TfBeBl describes a tidal flat, followed landward by a beach, and followed further landward by a bluff or cliff. The data were gathered primarily from aerial reconnaissance flights over two field seasons. Additional data were gathered from maps and vertical aerial photographs.

Preliminary judgments on whether a given segment of coast is eroding (a sediment source), accreting (a sediment sink), or stable can be made from the groupings of physiographic features. For example, where a bluff or cliff forms the shoreline or occurs landward of a beach, the coast can be considered erosional or a sediment source. However, the occurrence of a beach ridge complex seaward of a bluff or cliff would indicate that the coast is presently or was recently accreting, but had been eroding in the past. The presence of a barrier island or spit indicates that the area is or has recently been accretional or a sediment sink. The character of the barrier provides further information. For example, a barrier with no beach ridges is subject to frequent overwash relative to a barrier with beach ridges. A beach followed landward by a slope or plain would be considered stable. Groupings of physiographic features found within the study area and judgments of whether each is erosional, accretional, or stable are given in Table 2.

Judgments of this type, however, are subject to complications. For example, beach-ridge complexes, even though they represent past accretion, may be truncated in places by the present shoreline and, if so, represent local erosion which followed the accretion. Even though a barrier is an accretional landform, the barrier may presently be eroding due to depletion of the sediment source and/or migration landward by overwash processes. In fact, a barrier may easily erode faster than a cliff of hard bedrock. Additional studies are required to precisely determine coastal stability.

SUMMARY OF RESULTS

The coastal morphology of the northern Bering Sea coast of Alaska is dominated by bluffs or cliffs (greater than 52%; Table 1).

TABLE 1: SYMBOLS AND PERCENT OCCURRENCES OF COASTAL PHYSIOGRAPHIC FEATURES

SYMBOL	DEFINITION	% OCCURRENCE
Tf	TIDAL FLAT: Gently sloping intertidal area found seaward of the beach. It is unvegetated and is commonly composed of relatively fine sediments (muds or silts).	16
O	OUTCROP: Exposure of relatively resistant material (rock and mud) on the beach foreshore.	1
Be	BEACH: Accumulation of unconsolidated sediment (ranging in size from sand to boulders) found between the low tide line and the next physiographic feature landward (e.g. beach ridge).	75
Rs	SINGLE BEACH RIDGE: Ridge of unconsolidated sediment landward of the beach. It is often vegetated and oriented parallel to the present shoreline. Ridges in the study area are formed by swash processes (see text).	2
Rc	BEACH RIDGE COMPLEX: Multiple occurrences of beach ridges. Individual ridges are oriented parallel to past shorelines.	11
Ba	BARRIER SPIT OR ISLAND: An elongate body of unconsolidated sediment, partly above the high-tide line, that partially or completely encloses a body of water.	16
Bl	BLUFF OR CLIFF: A near-vertical slope that was eroded into unconsolidated deposits or rocks by waves.	52*
S	SLOPE**: A relatively steep slope landward of the beach that was not eroded by waves. Intermediate between bluff and plain.	***
P	PLAIN**: A gentle or near-horizontal slope shoreward of the beach.	***
/	To be read as 'composed of'. For example, Ba/BeRs would be read as a barrier 'composed of' a beach followed landward by a beach or dune ridge.	
-	To be read as 'or'. For example, Be(Rs-Bl) would be read as a beach followed landward by a single ridge 'or' a bluff; the coast has not been divided into segments of BeBl and BeRs because either the division would result in segments of coast too small to be discernible at the scale of the map or data were not sufficient to justify the division.	
m	Indicates physiographic features which are relatively minor.	

notes:

* Includes 15% of small scale bluffs (Blm). Does not include 14% of Bl-BeS, Be (Bl-S), and Be(Bl-P).

** Slope and plain were used to characterize what occurs landward of a beach ONLY when none of the other physiographic features discussed here were present.

*** Percentages were not computed because of reasons given in note **.

TABLE 2: PERCENT OCCURRENCE OF COASTAL TYPES *

ACCRETIONAL		EROSIONAL		STABLE		EROSIONAL OR STABLE	
Ba/Be	7	Bl	25	BeP	8	Bl-BeS	11
Ba/BeRs	2	BeBl	24	BeS	6	Be (Bl-S)	2
Ba/BeRc	7	Bl-BeBl	1			Be(Bl-P)	1
BeRc	4	OBeBl	<1				
BeRcBl	<1**	OBe(P-S)	1				
TOTALS	21		52		14		14

notes:
* Does not include tidal flats.
** Included in the accretional category although these reaches of coast have been erosional in the past.

Generally, these are of three types: 1) high, resistant rock cliffs found, for example, between the Bering Strait and Port Clarence, and at the entrances to Golovnin and Norton Bays; 2) relatively low bluffs eroded into muds found, for example, in the Nome area and west of St. Michael on the south side of Norton Sound; and 3) resistant but relatively low cliffs eroded from old lava flows east of St. Michael. Each of these types of bluff or cliff coasts are considered erosional, but of course the rates of erosion of the mud bluffs can greatly exceed the other types. For example, preliminary comparisons of charts and aerial photographs from 1951 and 1976 respectively show the low mud bluffs west of St. Michael have retreated approximately 200 m (a rate of 8 m per year).

Beaches occur along 75% of the coast (Table 1). Areas lacking beaches are, in general, associated with bluff or cliff shorelines discussed above, but not all bluff and cliff shoreline features lack beaches. The Nome area, for example, has well developed beaches followed landward by bluffs. Such areas may be eroding as rapidly as cliffs without beaches, or even more rapidly.

Erosional outcrops on beach foreshores were observed along approximately 1% of the coast. These were confined to two areas, rocky outcrops west of Nome and muddy outcrops along a segment of coast north of Moses Point in Norton Bay.

Barrier islands and spits occupy 16% of the coast (Table 1). These include a classic recurved spit, 20 km in length, enclosing Port Clarence in the northern part of the study area and barrier spits, 30 km in length, enclosing Safety Sound east of Nome.

Beach ridges occupy 13% of the coastline (Table 1) and are generally associated with barrier islands and spits (Table 2). All the ridges in the area mapped here are of swash origin and represent a berm stranded by coastal accretion. Development of foredune ridges of eolian origin is impeded in this area by the coarse texture of the beach sediments.

Tidal flats occur along 16% of the coast. These are located predominantly in Norton Bay, where the wave energy is low.

Over 52% of the coast is interpreted as erosional, whereas only 21% is interpreted as accretional(Table2). Fourteen percent of the coast is considered stable and 14% is considered either erosional or stable.