# 6. COASTAL GEOLOGY MAPPING: AN EXAMPLE FROM THE SVERDRUP LOWLAND, DISTRICT OF FRANKLIN

Project 780043

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## Abstract

*A system for coastal geology mapping is discussed which has been tested at scales ranging from 1:4800 to 1:125 000, in a variety of Canadian coastal environments including the Sverdrup Lowland. The system is compatible with the surficial geology mapping schemes used by the Geological Survey of Canada. Initially, the coast is progressively subdivided into shore units, zones and components which are the building blocks used to define the physical coastal characteristics and a limited number of replicate shore types. Use of standardized codes allows a direct comparison between coasts of different geographic areas. All available coastal information is systematically listed on coding sheets and a summary of the primary coastal elements is shown on the maps using coded descriptors. Also displayed on the maps is the distribution of replicate shore types.*

## Introduction

The growth of interest in coastal geological studies over the past decade has focussed in part on mapping of physical shoreline features. At present, coastal geology maps are available for only selected parts of the Canadian coastline. Several methods have evolved to compile and display coastal information. For example, some mapping schemes used in eastern Canada include those of Dubois (1973), Scarlett et al. (1976), Barry et al. (1977) and McLaren (1980). Important now is the need to develop a mapping system so that a uniform series of coastal maps can be produced for the country. The system should be applicable at a variety of scales and to the variety of coastal settings found in Canada. The system should be multi-user oriented and suitable for storage of information on computer files for quick retrieval and analysis. In an attempt to develop such a system, it was thought desirable that it also be compatible with the existing surficial geological mapping schemes used by the Geological Survey of Canada (GSC). Consequently, a system was designed based on systems developed for surficial geology by the Survey (e.g. Fulton et al., 1974, 1975; Barnett et al., 1975, 1976; Boydell et al. 1975a, b) and refined by the Environment and Land Use Committee (E.L.U.C.) (1978). The system was developed initially as a joint study with the Resource Analysis Branch of the British Columbia Ministry of the Environment and was also partially funded by Lands Directorate of Environment Canada. The mapping was tested at scales of 1:4800 (Capital Regional District, 1979) and 1:20 000 (Owens, 1980). Additional mapping using the system has also been carried out in British Columbia by D. Howes (personal communication, 1980) and by J.R. Harper (personal communication, 1980) at scales of 1:25 000 and 1:10 000 respectively. Low altitude, oblique colour video tapes were used as the primary data base for these studies.

The objective of this paper is to describe and illustrate how physical coastal information is organized, coded and displayed in the proposed mapping system by using an example of a mapping program recently completed in central Sverdrup Lowland, District of Franklin (Woodward-Clyde Consultants, 1980). Shores in the Sverdrup Lowland (Fig. 6.1) represent a very simple model with which to introduce the mapping system because of the limited coastal information base and the scale of mapping (1:125 000). Although some oblique, low-altitude, colour photography and field observations were available (Taylor, 1980, Fig. 6.2), the majority of the program was conducted using vertical aerial photography (1:60 000). Mapping was completed on King Christian, Lougheed, and Cornwall islands, south Amund and Ellef Ringnes islands, and Sabine Peninsula, Melville Island (Fig. 6.1).

## Coastal Geology Mapping System – Conceptual Framework

The mapping system involves three key elements:

a. use of a progressive subdivision or hierarchy of scales to examine the coast;
b. development of a flexible information format using coding sheets, and standardized codes to describe the physical coastal characteristics; and
c. preparation of maps which summarize the basic shore-zone characteristics and the distribution of replicate shore types.

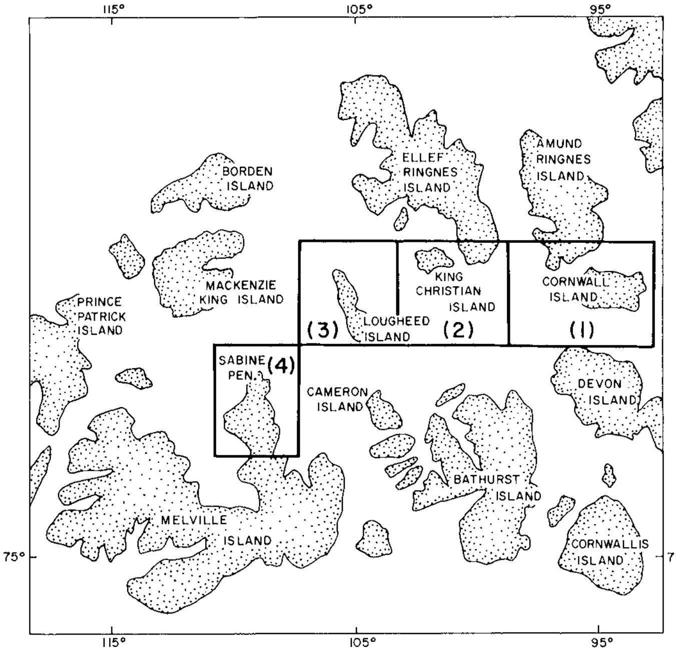

***Figure 6.1.*** *Location of the coastal mapping project in the central Sverdrup Lowland. For each of the four geographic areas outlined, a set of maps (scale 1:125 000) was completed that summarize the physical coastal characteristics.*

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## Table 6.1

Detailed physical characteristics of each shore unit, e.g. KC 4 are documented on coding sheets. In this case, only two across-shore zones are described for each shore unit. They are the terrain zone and the shore zone. Information on the surficial materials, trafficability and sensitivity of the terrain is derived from reports by Hodgson (1977, 1978). A summary of the primary shore zone characteristics is provided in columns 3 and 4 and displayed on the map (Fig. 6.3).

LOCATIONS: King Christian Island KC
Ellef Ringnes Island ER
MAP SHEET: 69C (+69D)
CODING SHEET: 1 of 8

| UNIT |  |  |  |  | SUMMARY |  | TERRAIN CHARACTERISTICS |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | COMPOSITION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| IDENTIFICATION | HOMOGENEOUS | PRIMARY | SECONDARY | VARIANT | COASTAL CLASS | COASTAL UNIT DESCRIPTOR | PHYSIOGRAPHY | GEOLOGICAL FORMATION | SURFICIAL MATERIALS | SLOPE CLASS | SLOPE MODIFIERS | POOR DRAINAGE | DRAINAGE DENSITY | GULLYING/NIVATION | INSTABILITY FEATURES |
| 1 | 2 |  |  |  | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| KC1 | 4 |  |  |  | 4 | sIWm-SRw | Lp | Ki | sW(b) | 1 | r | - | L | Y | - |
| KC2 | 4 |  |  |  | 7 | sFl-T | Lp | Ki | $sFd^{A}$ | 1 | - | NA | NA | Y | - |
| KC3 | 4 |  |  |  | 4 | sIWl-SRw | Lp | Ki | sW(b)+Ff | 1 | r | - | M | Y | - |
| KC4 |  | 3 |  |  | 4 | sIWl-SBRw | Rsl | Ki | sWb + Ff | 1 | r | - | M | Y | PI |
|  |  |  | 2 |  | 7 | sFl-T | Rsl | Ki | $sFd^{A}$ | 1 | - | NA | NA | Y | - |
|  |  |  |  | $v^{1}$ |  |  | Rsl | Ki | sWb + Ff | 1 | - | - | NA | - | - |
| KC5 |  | 3 |  |  | 4 | fIWl-SBRw | Rsl | Ki | $\frac{fW}{R}$ | 2 | - | - | M | Y | PI |
|  |  |  | 2 |  | 7 | sFl-T | Rsl | Ki | $sFd^{A}$ | 2 | - | NA | NA | Y | - |
| KC6 |  | 4 |  |  | 8 | fIm-SRi | Lp | Ki | $fW + Fd^{I}$ | 1 | - | Y | L | - | RI |
|  |  |  | 1 |  | 7 | sFl-T | Lp | Ki | $sf\ Fd^{A}$ | 1 | - | NA | NA | - | - |
| KC7 |  | 4 |  |  | 8 | fIKm-FRik | Lp | Kcl | $fW + Fd^{I}$ | 2 | - | Y | M | Y | RIS |
|  |  |  | 1 |  | 7 | $\frac{s}{f}$ Fl-T | Lp | Kcl | $\frac{s}{f}\ Fd^{I}$ | 2 | - | NA | NA | Y | - |

| UNIT | SHORE ZONE CHARACTERISTICS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  | PROCESSES |  |  |  |  |  |  |  |  | FORM |  |  |  |  |  |  |  |  |
|  |  |  | FLUV. |  |  |  | WAVES | ICE |  |  |  |  |  |  |  |  |  |  |  |
| IDENTIFICATION | TEXTURE | EOLIAN | PRESENCE | SEDIMENT SUPPLY | COLLUVIAL | THERMOKARST | MAX. OBS. FETCH | LEAD WIDTH | THRUSTING | PILING | NEAR SHORE SLOPE | FORESHORE SLOPE | CLIFF | BEACH | DELTA | BARRIER | SPITS | SHORELINE CHANGE | NET. SED. TRANSPORT |
| 1 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| KC1 | s | - | Y | M | - | - | 4 | 1 | 2 | Ps | mb | L | - | Bi | T | - | - | 0 | - |
| KC2 | s | - | Y | M | - | - | 4 | 1 | 2 | - | mb | L | - | Bi | T | - | - | + | - |
| KC3 | s | Y | Y | M | - | - | 4 | 0 | 2 | Ps | lb | L | - | Bi | T | - | - | 0 | - |
| KC4 | s | Y | Y | M | - | - | 4 | 3 | 3 | Ps | mp | L | - | Bb | T | D | - | 0 | R? |
|  | s | - | Y | M | - | - | 4 | 3 | 3 | Ps | mp | L | - | Bi | T | D | - | + | - |
|  | s | Y | - | - | - | - | 4 | 3 | 3 | Ps | sp | L | - | Bb | - | - | - | 0 | R? |
| KC5 | f | Y | Y | M | - | - | 4 | 0 | 2 | Ps | mb | L | lb | Bb | T | D | - | 0 | - |
|  | s | Y | Y | M | - | - | 4 | 0 | 2 | Ps | mb | L | - | Bi | T | D | - | + | - |
| KC6 | f | - | Y | M | S | - | 4 | 1 | 3 | Po | sb | M | - | Bi | - | - | - | + | - |
|  | s | Y | Y | M | - | - | 4 | 1 | 3 | Po | sb | L | - | Bi | T | D | - | + | - |
| KC7 | f | - | Y | M | S | - | 4 | 1 | 3 | Po | sb | M | (lh) | Bi | T | D | - | 0 | R? |
|  | $\frac{s}{f}$ | Y | Y | M | - | - | 4 | 1 | 3 | Po | sb | L | - | Bi | T | D | - | + | R? |

| UNIT | LAND USE INTERPRETATIONS |  |  |  |  | RELIABILITY |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDENTIFICATION | ICE RICH | AGGREGATES | WATER SUPPLY | TRAFFICABILITY | TERRAIN SENSITIVITY | A/P SCALE | OBLIQUE A/P | GROUND PHOTOS | BEDROCK GEOLOGY | SURFICIAL GEOLOGY | OTHER DATA | AIR PHOTOGRAPH NUMBERS |
| 1 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 |
| KC1 | - | 2 | 1 | A2/1 | L | 6 | A | - | A | A |  | A17237 (29 - 30) |
| KC2 | - | 2 | 1 | A2/1 | L | 6 | A | - | A | A |  | same |
| KC3 | - | 2 | 1 | A2/1 | L | 6 | A | - | A | A |  | same |
| KC4 | - | 2 | 1 | A2/1 | L | 6 | A | A | A | A | I | A17237 (29 - 31) |
|  | - | 2 | 1 | B2/2 | Mbc | 6 | A | - | A | A |  | same |
|  | - | 2 | 1 | A2/1 | L | 6 | A | A | A | A | I | same |
| KC5 | - | 2 | 1 | B3/2 | Mabc | 6 | A | - | A | A |  | A17237 (31 - 32) |
|  | - | 2 | 1 | B3/2 | Mabc | 6 | A | - | A | A |  | same |
| KC6 | Y | 1 | 0 | B2/2 | Mbc | 6 | A | - | A | A | I | same |
|  | - | 1 | 1 | B2/2 | Mbc | 6 | A | - | A | A |  | same |
| KC7 | Y | 0 | 0 | A3/2 | Mabc | 6 | A |  | A | A |  | A16751 (197 - 198) |
|  | - | 1 | 1 | A3/2 | Mabc | 6 | A | - | A | A |  | same |

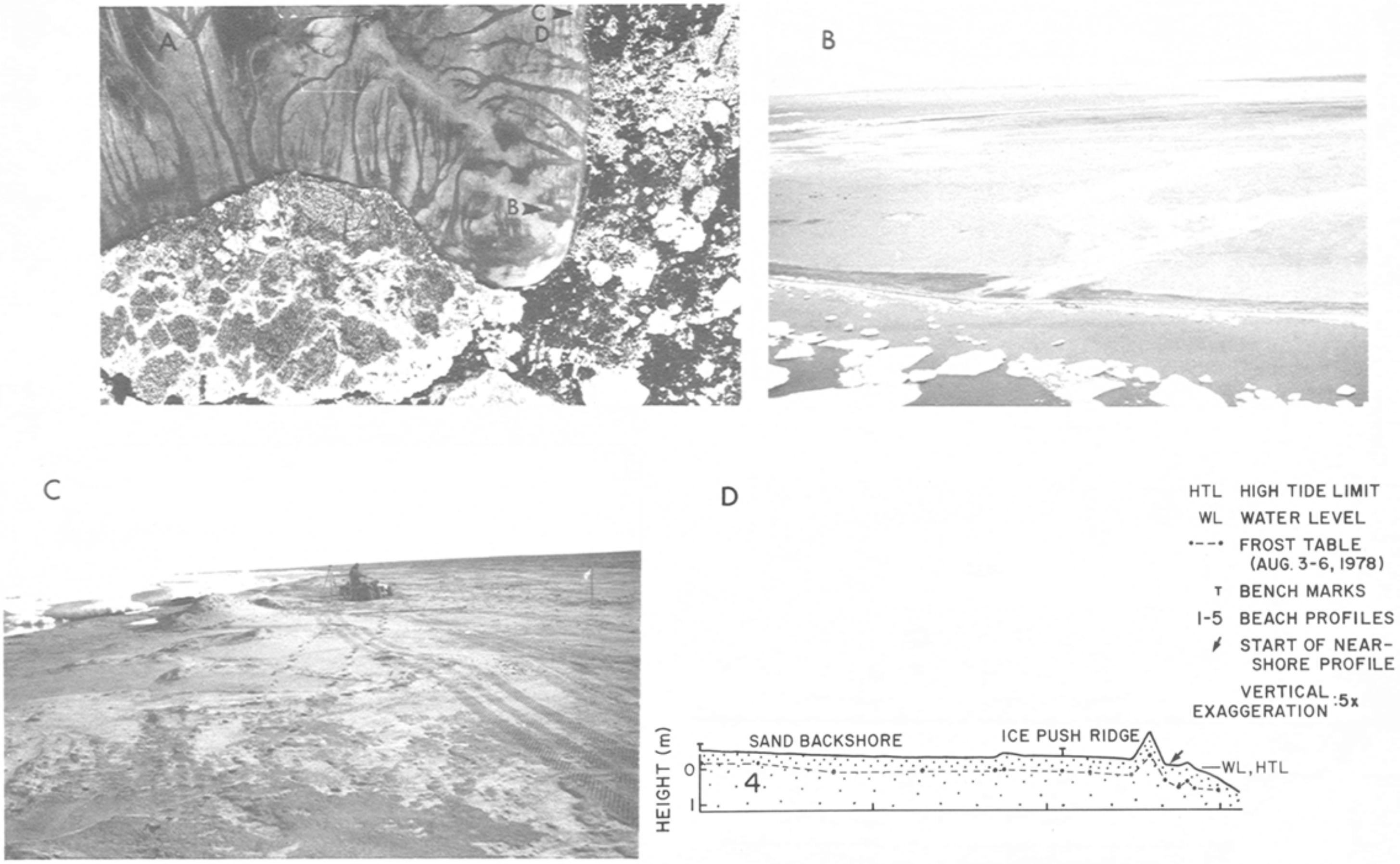


***Figure 6.2.*** *An example of the information base used to interpret the coastal characteristics in the Sverdrup Lowland. Often only vertical aerial photography (1:60 000) was available (A), however for King Christian, S. Ellef Ringnes and Cornwall islands there was also oblique coastal photography (B) flown at 125 m altitude in 1976 or 1978 and some field observations (C, D). This figure illustrates the shore zone at and just north of Cape Abernethy, King Christian Island (KC 4 – Fig. 6.3).*

## Subdivision of Coastal Zone

A flexible and practical method for coastal-zone analysis is to subdivide the coast into smaller sections until the desired or most appropriate scale is achieved. A systematic examination of a coastline reveals segments of coast which are very similar and others which are different. Thus, the coast is initially divided into a series of shore units each of which is homogeneous alongshore e.g. a continuous sand beach. The units are described in terms of across-shore zones which are usually divided on the basis of tidal zones (supratidal, intertidal, subtidal). The alongshore boundaries of a unit (indicated by a double slash – Fig. 6.3) are defined by a change in character of one or more across-shore zones. For instance, a new shore unit is defined where the slope or texture change in one of the tidal zones. A shore unit usually extends from the seaward limit of nearshore processes to the landward limit of marine processes or the top of a coastal cliff

The across-shore zones can be further divided into components which define specific geomorphological features (e.g. storm ridge) which implicitly provide information on the process(es) that controls or developed each feature.

The extent to which a coast is subdivided is a function of the availability of information and of the proposed scale of mapping for each mapping program. For instance, in the British Columbia coastal mapping programs cited above, shore components were the primary building blocks used to describe the shore zone. In the present study, the extremely limited coastal information base restricted the extent to which the shore unit could be divided. Moreover, there was a requirement for information about the adjoining hinterland for the planning of support facilities for marine terminals. As a result, the shore units were divided into only two across-shore zones – the terrain zone and the shore zone. The terrain zone included land adjoining the beach extending to the 30 m contour, and the shore zone included the beach and, where information was available, the nearshore.

Often a section of coast is characterized by a close repetitive series of two or more homogeneous units, e.g. KC 4 (Fig. 6.3) – sequence of sand beaches and river deltas. Since mapping of each individual homogeneous unit would involve considerable repetition, it is more practical to use composite units. Each composite unit is subdivided into primary and secondary parts. The primary subdivision is the predominant repetitive sequence and it accounts for 50 per cent or more of the unit length. The secondary subdivision (indicated on maps by single slashes encompassing the symbol $S^{1,2,3}$...n) is the minor repetitive association and may account for up to 50 per cent of the unit length. It is possible that two or more secondary subdivisions may be identified. If the physical characteristics are similar the secondary subdivisions are identified by the same superscript, e.g. $S^1$; if their characteristics change, the superscript also is changed, e.g. $S^2$.

Table 6.2

Eight generalized shore types are defined for the central Sverdrup Lowland. The distinguishing physical characteristics of each shore type and the pattern used on the maps (Fig. 6.3) to identify each are as follows:

1. Cliffed Coast

▥

consolidated or unconsolidated material, with or without talus

greater than 3 m in height

may be fronted by a beach

2. Banked Coast

▤

erosional coast characterized by scarps less than or equal to 3 m in height

may be fronted by a beach

banks may be discontinuous

3. Gravel Beaches

▨

generally associated with well-preserved raised beaches having a distinguishable surface relief

characterized by a moderate foreshore slope

4. Sand Beaches (Fig. 6.2)

░

characterized by a low to moderate foreshore slope; may include a low erosional bank in the backshore

frequently exhibit a dense network of consequent rills or streams

preferentially associated with sands and sandstones, most notably Isachsen and Eureka Sound Formations

5. Fine Textured Beaches (Fig. 6.4B)

▒

preferentially developed on shales, particularly on Christopher Formation

see text for additional information

6. Wide Intertidal Coasts

☰

shores with a wide shallow subtidal/intertidal area

contiguous terrain is generally lowlying but may have local areas of moderate angle slopes; the coastal area may be complex with many small embayments, discontinuous low banks, and localized deposits of marine reworked sediments (Lougheed Island)

7. Deltaic Coasts

▩

coasts dominated by active deltaic sedimentation

active deltas are invariably fan shaped with an arcuate front; channels are wide, shallow, and braided; deltas may project as much as 2 km beyond the adjacent coastline; channels frequently incised in older deltaic sediments; coastal areas at the active channel mouth may have discontinuous barriers which are initiated by ice thrusting, but may be reworked by waves and breached by river action

8. Ridged Coast (Fig. 6.4A)

>>>

generally associated with fine textured sediment derived from other fine textured materials (e.g., siltstone or shale) or with gravel deposits; may include low banks and beaches with a berm, but both are frequently and extremely modified by ice thrust

see text for additional information

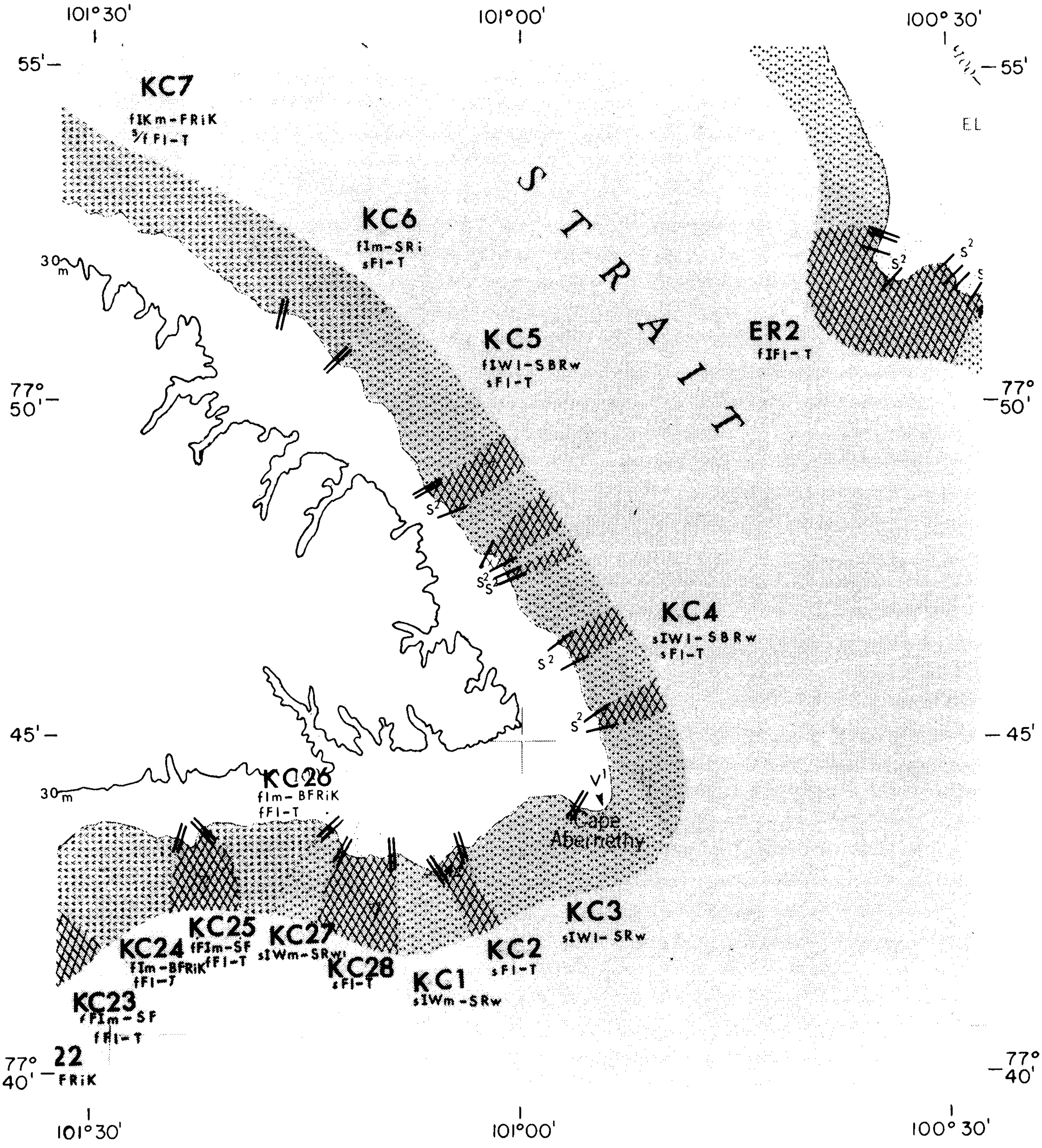


*Figure 6.3.* The coastal geology map of southeastern King Christian Island illustrates how the primary coastal characteristics are summarized and displayed. Initially shore units (outlined by double slashes) are defined e.g. KC 4, and each is described using a coded descriptor (Table 6.3). The distribution of generalized shore types (Patterns – Table 6.2) are shown alongshore and where applicable, secondary shore units ($S^2$) and variants ($V^1$) also are located.

Table 6.3

Shore unit descriptor – a simple descriptive code provides a summary of the physical character of each shore unit. The descriptor is defined in terms of four parameters. These are examples of some of the codes used to describe each parameter.

1. Texture of material

| | | |
|---|---|---|
| s | sand | $(0.063 < D < 2$ mm$)$ |
| f | fines | $(D < 0.25$ mm$)$ |
| s̸ | silt | $(0.004 < D < 0.063$ mm$)$ |
| ¢ | clay | $(D < 0.004$ mm$)$ |

2. Dominant process or processes operating on the shore zone

| | |
|---|---|
| F | fluvial |
| I | marine (ice) |
| W | marine (wave) |
| K | thermokarst |

3. Slope of foreshore

| | |
|---|---|
| l | low slope |
| m | moderate slope |
| s | steep slope (angle of repose or steeper) |

4. Shore zone morphology

| | |
|---|---|
| B or Bb | beach with berm |
| F | bank, height <3 m |
| S | simple inclined surface |
| T | delta, braided channel, fan |
| Ridged morphology – | |
| Ri | due to sea ice thrusting |
| Rk | due to thermokarst |
| Rw | due to presence of raised beaches |

Example of Descriptors

Descriptor sWm – SBF
↑↑↑ ↑↑
Parameters 123 4

This unit exhibits a moderate sloping sandy shore zone dominated by marine wave processes. The foreshore has a simple incline topped with a berm. A low bank less than 3 m in height divides the backshore from the adjoining terrain.

$$\frac{\text{fIKm – SFRik}}{\text{sFl – T}}$$

This unit exhibits a moderate-slope fine-textured shore zone dominated by ice thrusting and thermokarst activity. The shore has a simple incline backed by a bank less than 3 m high and by a series of ridges formed from a combination of ice thrusting and thermokarst activity. A secondary coastal type which occurs within this unit is a low angle, sandy shore which primarily reflects the presence of fluvial processes and associated sediment deposition in a deltaic environment.

Often the continuity of a shore unit is interrupted by minor shore-zone features such as a spit or a small stream. A variant (indicated by the symbol $V^{1,2,3}$...n – Fig. 6.3) is used to delineate these minor features. Variants may in some cases be repetitive, but account for less than 10 per cent of the unit length. More than one variant may be identified in each shore unit.

In the Sverdrup Lowland study, primary subdivisions, because of the scale of mapping, were restricted to lengths greater than 2 km. Features or areas less than 2 km but more than 0.5 km in length were identified as secondary subdivisions or variants. To avoid unnecessary clutter, secondary subdivisions less than 0.5 km in length were generally not plotted on the maps; however, they were identified in the unit descriptor and described on the coding sheets, e.g. KC 5 (Fig. 6.3, Table 6.1). The relative percentage of the total shore unit length occupied by primary or secondary subdivisions or variants is coded on the coding sheets (Table 6.1: 1 ≡ 0-20%,... 4 ≡ 80-100%).

## Detailed Information Base – Organization and Coding

The detailed physical characteristics of each coastal unit are compiled on coding sheets (Table 6.1) by making use of standardized codes. The codes, which are a simple translation of descriptive terminology into alphabetic notation, are standardized for use in any coastal region of Canada. Although the total array of codes is already large, the system is flexible so that new codes can be added if necessary. For instance, additional codes were required in the Sverdrup Lowland project to reflect arctic conditions and the presence of sea ice and permafrost. In this paper, it is not possible to define all of the codes used; the reader is referred to the code books which accompany each mapping project (e.g. Owens, 1980; Woodward-Clyde Consultants, 1980).

The objective of the coding sheets is to display, in a systematic fashion the detailed physical characteristics of the shore units, across-shore zones, and shore components.

**Figure 6.4A.** *The dominant characteristic of the 'Ridged coast' is its very irregular hummocky topography. The desiccated ridges shown here on south King Christian Island (KC 26, Fig. 6.3) were formed by ice push.*

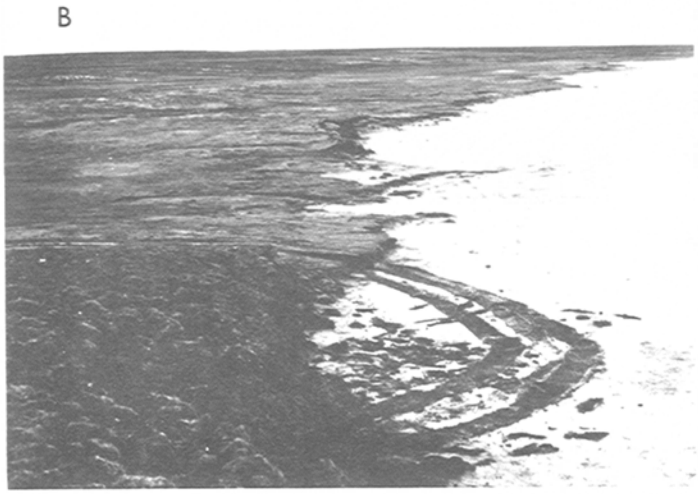


**Figure 6.4B.** *An absence of normal beach form and the presence of one year old all-terrain cycle tracks (faint ones) across the intertidal zone, suggest little or no reworking by littoral processes along the shores of northern King Christian Island.*

The coding sheets allow a user to pull out relevant information for a specific purpose and the codes facilitate the storage and analysis of the data by computer.

Information on the coding sheets focuses on sediment texture, primary geomorphological features, and primary processes affecting each shore unit. However, flexibility in the coding sheet format allows it to be adapted to individual mapping projects. In the present study, the shore units were divided into only two zones but additional information on geology, land use interpretations and specific hazards to development were included because of their usefulness in the preliminary selection and assessment of sites for marine terminal facilities.

Each shore unit is identified on the maps and the coding sheets by an alphabetic code and a number. The alphabetic code refers to a specific island and the units on each island are numbered consecutively e.g. KC 3 is King Christian Island unit 3 (Fig. 6.3). Once the physical characteristics of each unit are listed on the coding sheets, the primary elements of each shore unit are summarized and displayed as a coded unit descriptor (Tables 6.1, 6.3). The shore unit descriptor summarizes the following information: (1) sediment texture, (2) dominant process or processes operating on the unit, (3) foreshore slope, and (4) shore zone morphology. Two examples of shore unit descriptors and their interpretation are provided in Table 6.3. In the case of a composite shore unit, the descriptor of the primary subdivision is displayed above the descriptor of the secondary subdivision.

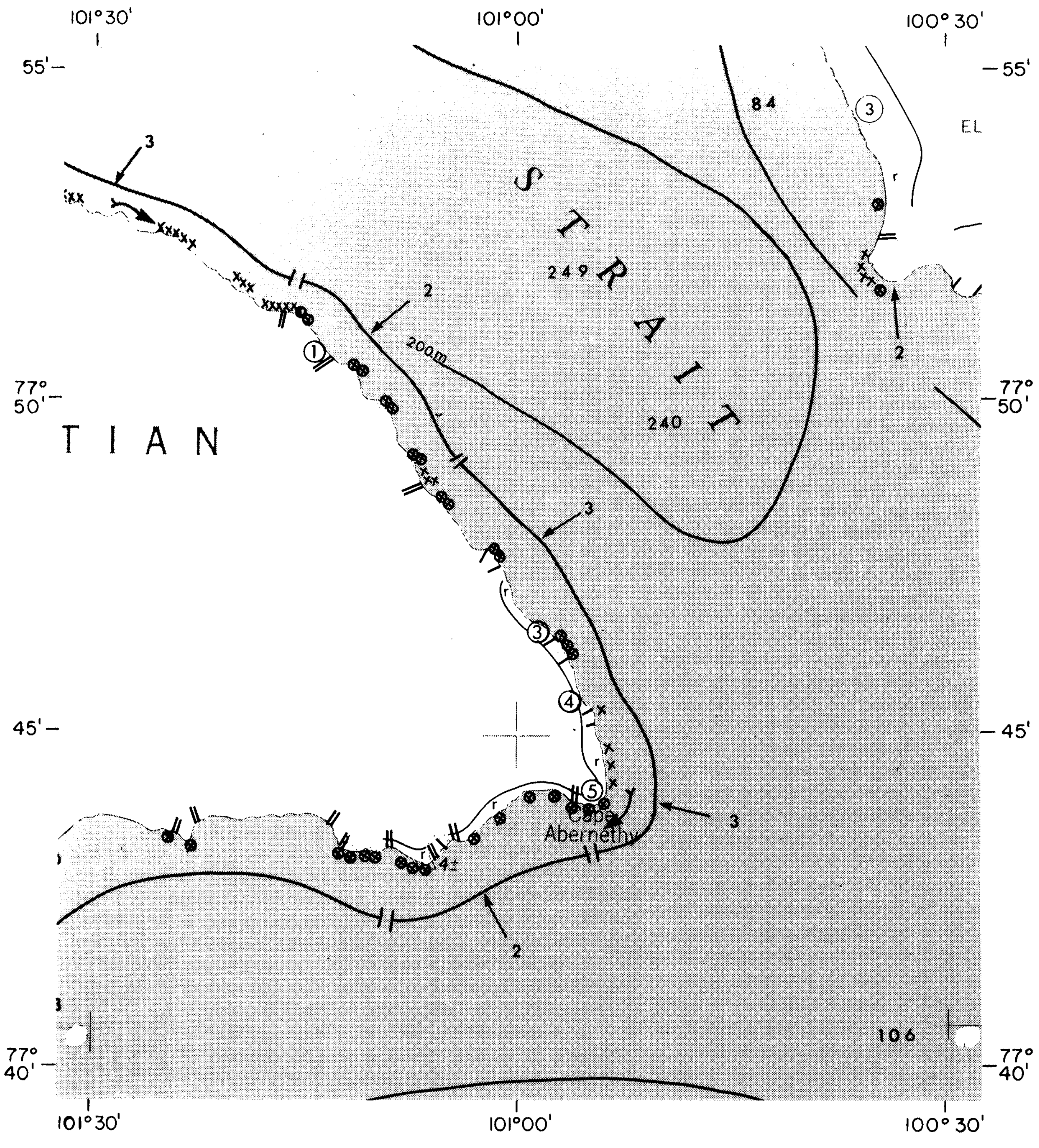
The detailed physical coastal information is also used to define a limited number of generalized replicate shore types or coastal classes for the study area. In the central Sverdrup Lowland eight replicate shore types are defined (Table 6.2). The most common shore type is the sand shore or 'Sandflat' coast (McLaren, 1977; Taylor, 1980) which is characterized by continuous sand beaches with a very gradual slope (Fig. 6.2). Two other shore types strongly reflect the arctic environment. (1) The 'Ridged' coast is characterized by very irregular hummocky ridges, generally formed by sea ice thrust, but due in some cases to retrogressive thaw flow slides (KC 26, 7 – Fig. 6.3, 6.4A). The 'Ridged' coast is often associated with shores composed of fine grained sediments. (2) The 'fine-textured' beaches are composed of sediment finer than medium sand. Although the size of sediment is primarily a function of the underlying bedrock or source rock, the absence of a normal wave-built beach profile reflects the limited wave energy conditions due to fetch restricted by sea ice (Fig. 6.4B).

## Coastal Geology Maps – A Summary

A synthesis of the detailed physical coastal information listed in the coding sheets is displayed on maps so that a user can obtain a quick overview or summary of the primary shore characteristics. A set of two maps is prepared for each island. The first map (Fig. 6.3) focuses attention on the location of shore units, the shore zone characteristics and the distribution of replicate shore types. Adjacent to each shore unit is a coded descriptor which summarizes the physical characteristics of the unit. The distribution of replicate shore types is shown using distinctive patterns (Fig. 6.3) and their distinguishing characteristics are listed in the map legend (Table 6.2). The only terrain information provided is the map contours. The 100 foot (30 m) contour is accented in the present study because it is used to compute a representative slope between it and the shoreline. Additional information pertaining to the coastal hinterland e.g. terrain sensitivity, is displayed only in the coding sheets.

On the second map, emphasis is on plotting process elements, e.g. winds, tides, currents, waves, and factors which affect littoral processes, e.g. nearshore bathymetry. However in the central Sverdrup Lowland, process information is extremely limited. In this study symbols were used to indicate shores affected by sea ice-thrusting and ridging, the direction of longshore sediment transport, nearshore bathymetry, and the extent of raised beaches (Fig. 6.5). As more process information becomes available, it can be added to the maps. Boundaries of shore units are plotted on the second map to facilitate a comparison with information on the first map.

Other relevant coastal information such as field observations of beach profile or sediment sample data are included on one or both of the maps as inset diagrams or tables.


101°30'
101°00'
100° 30'
55'
55'
77° 50'
77° 50'
45'
45'
77° 40'
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S T R A I T
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EL
84
249
240
200m
106
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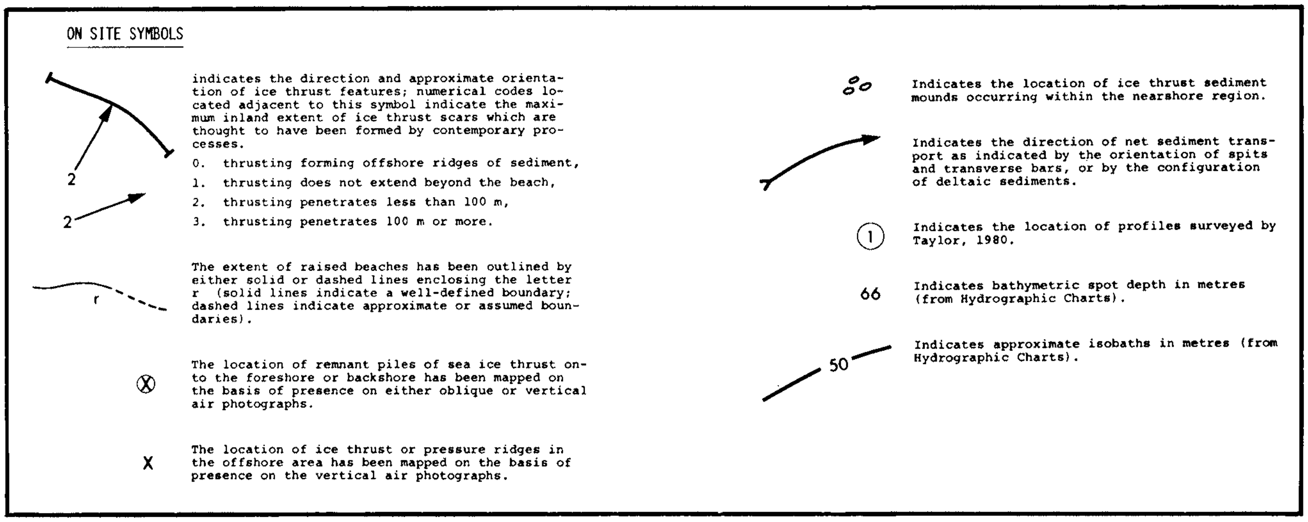

indicates the direction and approximate orientation of ice thrust features; numerical codes located adjacent to this symbol indicate the maximum inland extent of ice thrust scars which are thought to have been formed by contemporary processes.

0. thrusting forming offshore ridges of sediment,
1. thrusting does not extend beyond the beach,
2. thrusting penetrates less than 100 m,
3. thrusting penetrates 100 m or more.

The extent of raised beaches has been outlined by either solid or dashed lines enclosing the letter r (solid lines indicate a well-defined boundary; dashed lines indicate approximate or assumed boundaries).

The location of remnant piles of sea ice thrust onto the foreshore or backshore has been mapped on the basis of presence on either oblique or vertical air photographs.

The location of ice thrust or pressure ridges in the offshore area has been mapped on the basis of presence on the vertical air photographs.

Indicates the location of ice thrust sediment mounds occurring within the nearshore region.

Indicates the direction of net sediment transport as indicated by the orientation of spits and transverse bars, or by the configuration of deltaic sediments.

Indicates the location of profiles surveyed by Taylor, 1980.

Indicates bathymetric spot depth in metres (from Hydrographic Charts).

Indicates approximate isobaths in metres (from Hydrographic Charts).

***Figure 6.5.*** *For each of the geographic areas mapped, a second coastal geology map was used to depict process parameters (when information was available) and coastal characteristics which result from or affect the processes which dominate a particular shoreline. This map is of southeastern King Christian Island.*

## Summary

A coastal geology mapping system is proposed which can be used at a variety of scales, in a variety of coastal environments in Canada. Thus far, the system has been used at scales ranging from 1:4800 to 1:125 000 for coastlines in both temperate and arctic regions. The system is compatible with the surficial geology maps published by the Geological Survey; thus a uniformity of mapping is achieved and terrain information now can be directly incorporated into the coding sheets of the coastal geology maps. Following a systematic approach, all available physical coastal data can be included. The system is designed to present detailed information on the coding sheets and a summary of the primary coastal elements on the maps. With the coding sheets, a user can pull out relevant data for specific purposes such as oil spill countermeasures, coastal zone planning, etc. Also, since all available data are included, costly remapping of an area for specific users is eliminated. New information, when it becomes available, can be added to the data base because of the flexibility of the system. An index of reliability of the mapped data and other information is built into the scheme by listing all sources of information and by identifying field study areas and the location of reconnaissance aerial surveys.

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## References

Barnett, D.M., Edlund, S.A., Dredge, L.A., Thomas, D.C., and Prevett, L.S.
1975: Terrain classification and evaluation, Eastern Melville Island, N.W.T.; Geological Survey of Canada, Open File 252, 11 maps, 3 legends and 1318 p.

Barnett, D.M., Edlund, S.A., and Dredge, L.A.
1976: Terrain characterization and evaluation: an example from Eastern Melville Island; Geological Survey of Canada, Paper 76-23.

Barry, R.G., Crane, R.G., Locke, C.W., Locke, W.W., and Miller, G.H.
1977: The coastal environment of southern Baffin Island and Northern Labrador-Ungava; Institute of Arctic and Alpine Research, University of Colorado, Boulder, Report to Arctic Petroleum Operators Association, Project 138, 166 p.

Boydell, A.N., Drabinsky, K.A., and Netterville, J.A.
1975a: Terrain inventory and land classification, Boothia Peninsula and Northern Keewatin; in Report of Activities, Part A, Geological Survey of Canada, Paper 75-1A, p. 393-395.

1975b: Surficial geology and geomorphology maps of Boothia Peninsula, N.W.T.; Geological Survey of Canada, Open File 285.

Capital Regional District
1979: District of North Saanich Shoreland Protection Program; unpublished report prepared jointly by Willis, Cunliffe & Tait and by Woodward-Clyde Consultants, 59 p., plus map.

Dubois, J-M. M.
1973: Essai de classification de la zone côtière et d'identification d'unités physiographiques sur la côte du Saint-Laurent, Pointe-des-Monts – Blanc Sablon; Étude des Rivers du St-Laurent, Ministère de Travaux Publics du Canada, Montreal, 71 p.

Environment and Land Use Committee
1978: Terrain classification system; report to the E.L.U.C. Secretariat, prepared by the Resource Analysis Branch, British Columbia Ministry of the Environment, 56 p.

Fulton, R.J., Boydell, A.N., Barnett, D.M., Grant, D.R., Hodgson, D.A., and Rampton, V.N.
1974: Terrain mapping in northern environments; in Canada's Northlands, Proceedings of Technical Workshop to develop an integrated approach to base data inventories for Canada's Northlands, Environment Canada Land Directorate, April 17-19, 1974, Toronto, Canada, p. 14-60.

Fulton, R.J., Hodgson, D.A., and Minning, G.V.
1975: Inventory of Quaternary geology southern Labrador: an example of Quaternary geology-terrain studies in undeveloped areas; Geological Survey of Canada, Paper 74-46, 14 p.

Hodgson, D.A.
1977: A preliminary account of surficial materials, geomorphological processes, terrain sensitivity and Quaternary history of King Christian and southern Ellef Ringnes Islands, District of Franklin; in Report of Activities, Part A, Geological Survey of Canada, Paper 77-1A, p. 458-493.

1978: Surficial materials, southern Ellef Ringnes and King Christian Islands, Northwest Territories; Geological Survey of Canada, Open File 538.

McLaren, P.
1977: The coasts of eastern Melville and western Byam Martin Islands; coastal processes and related geology of a high arctic environment; unpublished Ph.D. thesis, University of South Carolina, Columbia, South Carolina, 304 p.

McLaren, P. (cont.)
1980: The coastal morphology and sedimentology of Labrador: A study of shoreline sensitivity to a potential oil spill; Geological Survey of Canada, Ottawa, Paper 79-28, 41 p. and maps.

Owens, E.H.
1980: Physical shore-zone analysis, Saltspring Island, B.C.; unpublished report to Lands Directorate, Pacific and Yukon Region, Environment Canada, Vancouver, 155 p.

Scarlett, M.S., Adams, D., Hoffman, L., Kirby, G., O'Brien, D., Pinsent, J., and Williams, W.
1976: Shoreline of Atlantic Canada; Memorial University, St. John's unpublished report, 60 p.

Taylor, R.B.
1980: Coastal reconnaissance for marine terminal planning in the Sverdrup Basin, Northwest Territories; Geological Survey of Canada, Open File 693, 150 p.

Woodward-Clyde Consultants
1980: Coastal geology maps, central Sverdrup Basin, Northwest Territories; Geological Survey of Canada, Open File 549.