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MARINE GEOLOGY, WESTERN PART OF PRINCE GUSTAF ADOLF SEA, DISTRICT OF FRANKLIN
Polar Continental Shelf Project

by

J. I. Marlowe
(Geological Survey of Canada)

REPORT B.I.O. 64-9

AUGUST 1964

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THE CANADIAN COMMITTEE ON OCEANOGRAPHY

B E D F O R D I N S T I T U T E O F O C E A N O G R A P H Y

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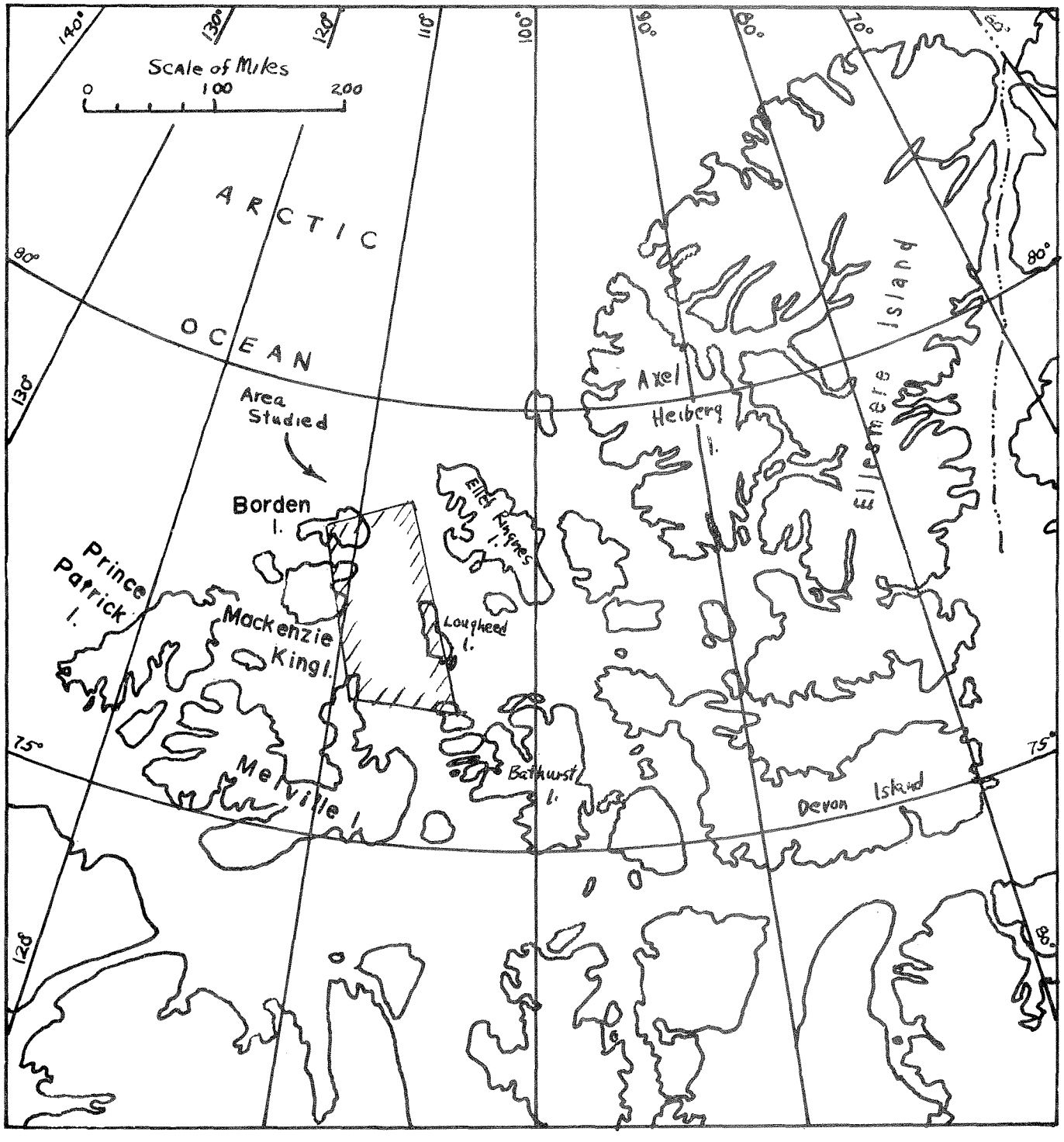

Figure 1 Index map, showing study area

MARINE GEOLOGY, WESTERN PART OF PRINCE GUSTAF ADOLF SEA, DISTRICT OF FRANKLIN
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Introduction:

This report is a preliminary compilation of results of field work carried out during the summer of 1963 in Prince Gustaf Adolf Sea. The work was part of a continuing project begun in 1960 in conjunction with the Polar Continental Shelf Project (Pelletier, 1962) and is a contribution to a regional marine geological study of the Canadian Arctic Islands. The area covered in this report includes the western half of Prince Gustaf Adolf Sea, parts of Wilkins and Desbarats Straits, and the northern entrance to Byam Martin Channel.

The study was carried out to provide information which will lead to an understanding of the recent geological history of the western Arctic Islands. Bottom samples were collected from selected stations in the inter-island channels. The stations were selected on the basis of a study of soundings made during the previous season.

Samples were collected by means of a light-weight piston corer of the Ewing pattern fitted with a 6-foot barrel. A snapper sampler was used as a tripping weight to provide extra sample material from the surface of the bottom. Stations were located by a Decca Navigator system and depths were measured directly by wire line. Transportation was provided by a Sikorsky S-55 helicopter.

E. R. Roots, Coordinator, and C. Grant, Field Supervisor,

od the Polar Continental Shelf Project, based at Isachsen, Ellef Ringnes Island, furnished the logistical support for the program. Soundings of the study area were provided by R. M. Eaton (1962), of the Canadian Hydrographic Service. Thanks are due to field assistants W. Johnson and J. Stewart and to helicopter crew H. Easton and R. Shand. Samples were processed in the laboratory by R. Cormier and S. Pitcher.

Physical Environment:

The dominant environmental factor of Prince Gustaf Adolf Sea and adjacent areas is a low average annual temperature. The sea is covered with ice during the greater part of the year and the land surface is frozen except for a short period in the summer. Surface runoff is at a maximum during the spring thaw period; throughout the remainder of the summer, only the largest stream beds have a surface flow. Rapid runoff of meltwater at the time of thaw carries a large volume of sediment to the sea. Much of this sediment is carried onto the shore ice where it later melts through in situ or is transported elsewhere by drifting before deposition. Where a shore lead exists, stream sediment is distributed into the littoral and sublittoral zones by debouching stream waters. In nearly all cases, the presence of shore ice affects stream sediment distribution in the marine environment. Only when streamflow is of sufficient volume to erode away the shore ice cover, can normal deltaic deposition proceed without hindrance.

Prince Gustaf Adolf Sea remained icebound throughout the summer of 1963. Sample collecting was not commenced until July,

at which time there were abundant cracks and drainage holes in the ice through which the sampling equipment was lowered. No mass movement of the sea ice was observed, however, ice thickness at sample stations averaged about 8 feet.

No current observations were made in 1963. A generally southward-setting drift is known in the area (Collin, 1961, Marlowe and Vilks, 1963). During the fall of 1962, a large ice island was observed to move southward down the east coast of Lougheed Island and through Byam Martin Channel (W. Black, Geographical Branch, personal communication).

Coastal Morphology:

The action of shore ice is the dominant coastal process in the western Arctic Archipelago. Short periods during which areas of open water exist along the coasts allow a limited amount of normal interaction between beach and sea to occur. These effects are later masked by the shoreward movement of sea ice under pressure from wind and possibly from currents. Beach morphology in the area of study is therefore related primarily to the nature of the shore sediment and secondarily to the exposure of the shore to the action of shore ice. The line of maximum shoreward transgression of the sea ice is commonly marked by irregular ridges and hillocks of beach sediment which has been plowed before the advancing ice.

The coasts of MacKenzie King and Lougheed Islands and the south half of Borden Islands are formed on poorly-consolidated sand and mud-size clastics of Mesozoic age (Thorsteinsson & Tozer, 1959). A deposit of unconsolidated quartz sand covers

the north half of Borden Island. All these coasts are low-lying and have little local relief. Their beaches are supplied with sediment by numerous ephemeral streams during the short summer period and the sediment is redistributed by the action of shore ice during the remainder of the year. All the coasts of the area show evidence of a net lowering of sea level in the form of terrace-like beach ridges which are preserved ten to twenty feet above the present shoreline.

There is little transport of beach materials alongshore. Beaches of the area are in a state of non-equilibrium, in which supply greatly exceeds demand. Sediment delivered to the beach by streams enters an environment of zero or very low wave and current energy; hence the net result of coastal processes is accretion on the beach at the expense of reduction of inland areas.

Common physiographic features along these coasts are lobate to digitate deltas and abandoned deltas. Where streamflow is of sufficient volume and duration to resist obliteration by ice action, deltaic forms extend well out from the shore. Deltaic aggradation results in lateral wandering of the lower reaches of many of these streams and many cases of complete abandonment can be seen (Fig. 2-D). Composite deltas form where two or more streams prograde their mouths to a point of juncture. Numerous examples of out-building by such delta coalescence can be seen along the west coast of Lougheed Island and the east coast of MacKenzie King Island. A characteristic of this type of shoreline is the delta lake, remnant from former shorelines which have become isolated from the sea by surrounding delta forms. Examples of this occur in East Bay,

MacKenzie King Island (Fig.2-A), and along the coasts of Lougheed Island. Cape Collingwood, a recurving digitate delta on the east coast of Sabine Peninsula, Melville Island, is an example of an intermediate stage of foreshore entrapment (Fig. 2-B).

Vegetation appears to be a major factor in controlling the shapes of deltas. Where coastal interfluves are well covered with mosses and lichens, deltas tend to be cuspate or digitate. Loose sand tends to form arcuate, rapidly prograding deltas. (Fig. 2-E).

Along shores which are exposed to heavy ice pressure, progradational forms are considerably modified. Parts of the southeast shore of Borden Island are marked by extensive barrier bars, some of which are attached to the mainland (Fig. 2-D). Lagoons behind these ice-shoved bars act as settling basins for fluvial sediment. Although this type of shoreline is smoother than the purely deltaic shoreline, it is nevertheless progradational.

Along the sandy coasts of Borden Island an intricate pattern of small arcuate deltas marks the shoreline (Fig.2-E). Irregular and scattered ice-shoved bars occur a half mile or more from shore, making it difficult, before the shore lead opens in the ice, to distinguish land from sea (Stefansson, 1915). At the southwest tip of Borden Island a long, narrow spit protrudes approximately one mile into Wilkins Strait (Fig. 2-F). This feature is considered to be a portion of a drowned subaerial drainage divide.

Drainage patterns on the southwest shore of Lougheed Island are erratic. On the primary control, a fracture set with a north-northwesterly trend, have been superimposed the effects of lowering sea level. Rejuvenation is locally evident and piracy is common

in the lower reaches (Fig. 2-C). Ponds are roughly aligned at uniform distances from the present shoreline.

The east coast of Sabine Peninsula, Melville Island, is generally similar to the low-lying coasts of the islands to the north. A distinctive anomaly is a gypsum piercement dome which comprises Cape Colquohon (Fig.3). The shore around this feature is cliffed and steep, and receives its sediment supply from local streams which drain the interior of the dome. Vesey Hamilton Island, off the north end of Sabine Peninsula, is worthy of note because of its well preserved, raised shorelines. This island is composed of poorly consolidated mudstone into which terraces have been cut by shore processes. The lower slopes of the island are covered with deposits of an efflorescent evaporite mineral, a previously unidentified hydrous sulfate (J. Jambor, Geological Survey, personal communuçation), which is possibly a product of reaction between the mudstone and evaporating sea water.

Submarine Topography

The western part of Prince Gustaf Adolf Sea has a bottom of moderate depth and gently undulating topography. Depths increase generally northward (Fig.3). The sea bottom in the area can be divided into three physiographic categories: (1) shoreface; (2) terrace; and (3) basin. A characteristic of the bottom which surrounds land areas in the western Queen Elizabeth Islands is a relatively steep slope with an abrupt break at about 300 metres depth (Horn, 1963, Marlowe and Vilks, 1963, Pelletier, 1962). Although this slope does not represent part of a present-day

equilibrium profile, it is here referred to as the shoreface (Price, 1955). The shoreface varies from five to more than ten miles in width but profiles across the slope are remarkably similar everywhere in the area. The base of the shoreface is considered to mark a former stand of sea level. It has been pointed out (Marlowe and Vilks, 1963) that the break in slope at the north end of Prince Gustaf Adolf Sea is approximately 100 metres deeper than that at the south end. This relationship holds true in the western half of the sea.

Fortier and Morley (1956) have postulated that regional drowning of land areas has occurred in the Arctic Islands. They proposed that many of the interisland channels reflect the pattern of an ancient subaerial drainage system. More detailed studies of the submarine physiography of the Sverdrup Islands (Horn, 1963, Marlowe and Vilks, 1963, Pelletier, 1962) support the view of Fortier and Morley. Indentations in the shoreface on the west side of Lougheed Island and the east side of MacKenzie King Island appear to be seaward extensions of present drainage trends. Southwest of Lougheed Island, the shoreface extends far from land and delineates a wide area of drowned terrestrial drainage divide. Depths over the area are 200 metres and less.

The terrace subdivision of western Prince Gustaf Adolf Sea extends southward from the Arctic Ocean to the latitude of Cape Ahnighito, on Lougheed Island (Fig.3). Depths over the terrace range from 300 to over 400 metres and bottom topography is irregular with low relief. The terrace slopes gently northward. A detailed study of the bottom topography between Cape

Ahnighito and Borden Island suggest the former existence of a north-trending drainage system which ran parallel to probable glacial drainage previously described (Marlowe and Vilks, 1963) in eastern Prince Gustaf Adolf Sea. The eastern part of Wilkins Strait, between Borden and MacKenzie King Islands is a straight channel of uniform depth.

In the area between Lougheed Island, MacKenzie King Island, and Sabine Peninsula (Fig. 3) the 500-metre contour indicates an elongate basin approximately 50 miles long and from 5 to 10 miles wide. The 400-metre contour reflects a westward extension of the shoreface from Lougheed Island into the basin. On either side of this extension, contour patterns suggest former drainage lines trending toward the basin. Detailed bottom contours show drainage corrugations along the western flank of the basin, all of which trend toward the deepest part of the basin. Soundings have not been made to the westward in Hazen Strait and it is not known whether the 400-metre contour closes on itself in that area. However, if sea level were lowered to 300 metres, the approximate lower limit of the shoreface, the basin area would become a restricted body of water with only limited circulation from the Arctic Ocean.

Sediments:

Bottom sediment in western Prince Gustaf Adolf Sea is predominantly mud, with minor amounts of sand and gravel. There is locally a trend to slighly coarser grain sizes with increasing depth beneath the bottom. A sharp colour contrast between surface

layers containing abundant fauna and deeper layers with no fauna is widespread in the area. Bedding structures are flat laminations or cyclical, slightly graded, layer sequences. Characteristic median grain sizes of samples from throughout the study area are fine silt to medium clay. Median sizes as large as coarse silt are found in nearshore and shoal areas. A more significant parameter than median grain size is the weight percent of sand grains in the sediment. Plots of sand contents of bottom samples (Fig. 3) show a direct relationship between shallowness of bottom topography and abundance of sand. The relationship between sand content and topography for samples from below the surface layer is more pronounced; it is, however, also more complex, in that high sand-content values are found not only over shoals but in the basin area.

The most apparent characteristic of bottom sediments in Prince Gustaf Adolf Sea is the colour contrast between the yellow-brown mud of the near-surface layers and medium to dark grey mud of the layers immediately below. There are local variations to this relationship but it is one which occurs generally over the entire floor of the sea (Marlowe and Vilks, 1963). The transition from dark to light coloured layers is sharp, although interlaminations of both types of sediment can usually be detected in a boundary zone. Laminations are common in the darker-coloured, deeper beds, but bedding in the light-coloured, near-surface layer is rare and is seen only in the lower few centimeters. This disappearance of layered structures coincides with the appearance of a benthonic faunal assemblage in the yellow-brown layer, and is probably a result of disturbance of bottom layers by mud-ingesting

organisms. Thickness of the upper, yellow-brown layer varies from 9 to more than 30 cm. In the area of this report the highest values for thickness of the upper layer occur on the shoreface or in the basin; intermediate values occur in the basin and over the terrace, while lowest values are found on the terrace (Fig. 3).

It is clear that conditions of sedimentation during the time of deposition of the yellow-brown, near-surface layer were significantly different from those which prevailed while the lower, darker beds were deposited. Therefore it is convenient to consider these two gross lithologies separately.

The lower beds have been cored to a depth of approximately 1½ metres below the sea bottom (Appendix, Core 74). At three stations (77, 71 and 79) the corer stopped in resistant, sandy mud which contained minor amounts of angular gravel fragments. Textures and structures in the bases of these three cores suggest that the lowermost beds are terrestrial or poorly re-worked glacial-marine deposits. Other cores in the grey beds stopped in sandy mud or mud. The grey beds are characteristically clay mud with admixtures of silt and sand. Granules and pebbles of grey clay shale occur in some cores (78, 68, 71 and 63), indicating that the grey colour of the lower beds is at least in part primary in origin. These shale granules and pebbles sometimes occur with resistant rock fragments of similar sizes. Beds containing shale pebbles are usually massive with no readily observable stratification. Such deposits may be indicative of rapid sedimentation and quick burial without post-depositional re-working. Indicators of bottom current velocity are varying amounts of sand found throughout the grey beds. Examples

of this are a graded bed of muddy quartz sand which occurs at the base of Core 80 and another which overlies mud in Core 71.

Cores from the basin area contain sequences of cyclic beds in the lower, grey layers. Nearly 1½ metres of cyclical sedimentation is recorded in Core 74, in which individual cycles range from 2 mm. to 2 cm. in thickness. The common sequence is a gradual upward transition from dark grey to light grey mud, followed by a sharply defined contact with the base of the next dark mud bed. There is no clear relation of colour to texture in the cycle. In Core 65, the lighter layers are coarser than the darker, while the reverse is true in Core 76. In other cores there is no size variation in the cyclical beds. There is a strong resemblance of these cyclical beds to seasonally deposited, glacial lake varves. In view of the occurrence of the beds in a topographic depression which would be restricted at a lower stand of sea level, it appears likely that they had a similar origin. If sea level in the area formerly stood approximately 300 metres lower than it does today, as is suggested by evidence previously discussed, the basin area would become a large inland water body with only restricted communication with the ocean. Evidence presented elsewhere (Horn, 1963, Marlowe and Vilks, 1963, Pelletier, 1962) points to the former existence of valley glaciers and ice caps over the western Queen Elizabeth Islands. Seasonal deposition in a restricted water body with poor circulation from an ice-dominated, terrestrial sediment source would produce rhythmically banded deposits of the type cored from the basin. Samples of the lower, grey beds taken from the terrace area show an extremely fine, flat, laminated structure, in which color banding is present but not so conspicuous as in the basin

area. Although it is difficult to account for the restriction of the entire Prince Gustaf Adolf Sea region, the almost complete lack of faunal remains and the presence of varve-like beds suggest that deposition occurred in a low-energy, non-ventilated, aqueous environment.

Core 62, from the shoreface, contains the only known faunal remains found in the lower, grey beds. The upper 5 cm. of the lower unit in this core is a sandy mud which contains abundant calcareous worm tubes and pelecypod valves, and represents a shallow water environment which was probably located near shore.

Evidence from two cores (63 and 71) shows that, while dark-coloured sediment was being deposited at some localities, light-coloured material was being deposited elsewhere. Yellow-brown clay pebbles in a dark grey matrix occur in Core 63, and a 22 cm. thick, brown sand bed is overlain and underlain by grey mud in Core 71. Although the contact with the yellow-brown, near-surface mud is sharp in gross aspect, fine interlaminations of dark grey and yellow-brown mud in the contact zone indicate that the conditions responsible for the colour change were related to source or environment of deposition, and not to post-depositional processes.

The near-surface, yellow brown beds are mud and sandy mud. Percentages of sand in these beds are greatest in the sublittoral zone and over shoals (Fig.3). Foraminiferal and other faunal remains are abundant in these beds and all except the lower few centimetres of the mud show evidence of burrowing and reworking. Bedding structures, where recognizable, take the form of flat-lying laminae.

Highest sand contents in the yellow-brown beds (Fig.3) are found at stations on the shoreface near the east coasts of Borden and Mackenzie King Islands and the north tip of Lougheed Island. The shoal area southwest of Lougheed Island in Desbarats Strait also has a high sand content. Textures in the near-surface layer indicate that little bedload-size clastic material is spread over the sea floor by drainage from nearby land areas. Mud-size sediment may be carried to sea as suspended load by stream runoff. Sand is distributed over nearshore areas by outbuilding deltas and by ice rafting. The Desbarats Strait shoal may reflect winnowing of fines by bottom currents in its sand content values.

Iron-oxide staining was noted in some cores. Cores recovered from the terrace area near the eastern entrance to Wilkins Strait contain limonitic sediment layers at depths of from 6 to 23 cm. below the surface. Casts of probable plant fibres were observed in a clayey sand in Core 62 which was taken from a depth of 151 m. Core 73, taken from East Bay, Mackenzie King Island, in 186 m. of water, contains a mud layer stained with iron oxide at 10 cm. All these layers are indicative of an oxidizing environment at the time of their deposition and it is inferred that water depths at these stations were much less than at present.

Figure 2. Coastal topographic forms.

A. Trapped foreshore in East Bay, Mackenzie King Island. A combination of delta progradation and ice shove has enclosed a section of the shoreline with a barrier beach.

B. Recurving, digitate delta -- Cape Collingwood, Melville Island. Unrestricted delta progradation by streams draining mossy ground has produced these elongate forms. Note the old delta berm scars at the end of the largest delta. If the prograding process is not interrupted, a portion of the bay will be cut off to form a large delta lake.

C. Erratic drainage -- west coast of Lougheed Island. In this instance, a strong north-northwesterly-trending fracture pattern is a primary drainage control. Rejuvenation is evident along the streams of this area. At the southern border of the map is an abandoned digitate delta. An abandoned stream meander path is shown as a dotted line in the lower half of the map. It appears that a reversal of drainage has occurred here; the two major active streams meet head-on at the north of the map and drain weakly out through the sandy delta.

D. Ice shove bars, southeast coast of Borden Island. Pressure from the Polar Pack on this exposed coast has constructed bars, which run roughly parallel to the shoreline, and disrupted drainage. Note the extremely erratic drainage at the far right of the sketch.

E. Intricate delta pattern, northeast coast of Brock Island; typical of coasts on the sandy Beaufort formation where polar ice pressure is not effective.

F. Spit, southwest Borden Island. This feature is a seaward extension of a drainage divide. Note the raised beach line.

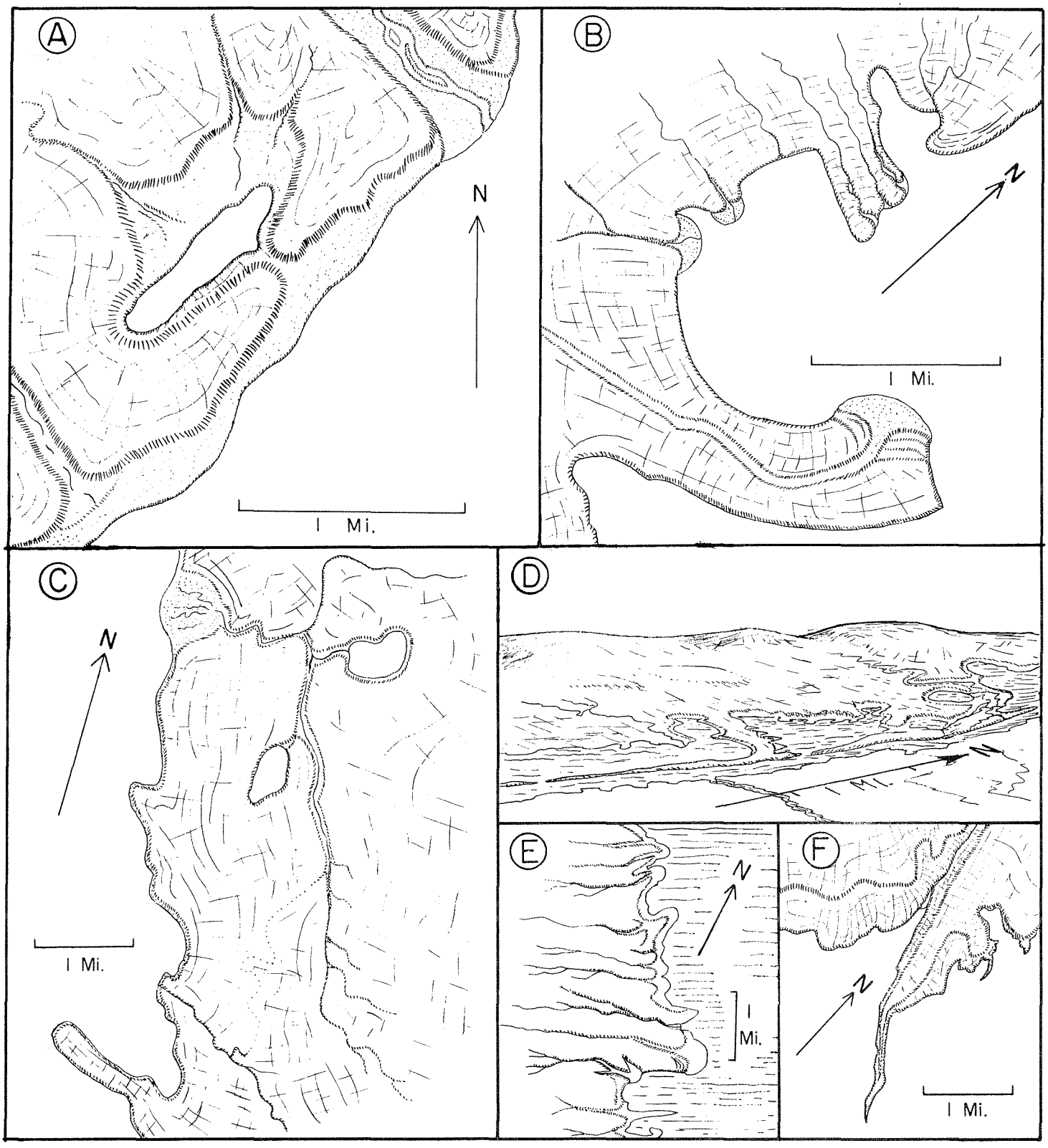

Figure 2 Coastal topographic forms.

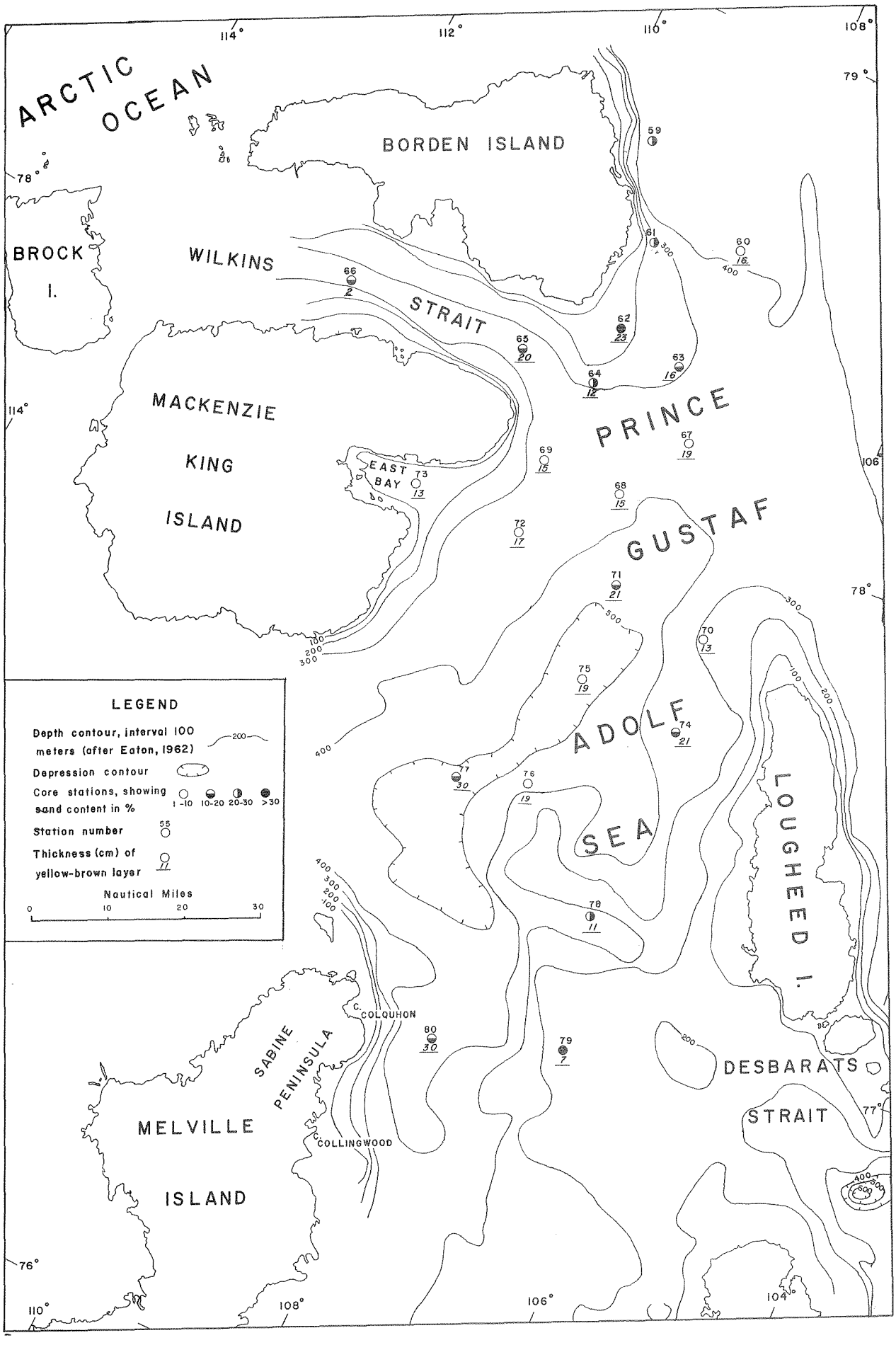

Figure 3 Generalized bottom topography, western Prince Gustaf Adolf Sea.

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Summary Logs of Core Samples
(See Figure 3 for Locations)

Core No.	Depth (Metres)	Description (Top to Bottom)
59	437	5 cm mud, yellow-brown, with calcareous foraminifera;
		10 cm mud, grey
60	411	14 cm mud, yellow-brown, interlaminated with grey mud in lower 7 cm; 4% fine to medium sand;
		17 cm clayey mud, grey; 33 cm mud, grey, 15% very fine sand.
61	338	6 cm fine sandy mud, yellow-brown.
62	151	23 cm mud, yellow-brown, fine sandy, very abundant calcareous foraminifera; contains 2 mm-thick zones of medium sand; few broken pelecypod valves; base sharp; 1 cm muddy sand, orange-brown, fine to very fine; heavily stained by iron oxide; limonitic plant fibre casts; 29 cm sandy mud, grey, frequent light grey sandstone fine pebbles; abundant pelecypod and calcareous worm burrow material in upper 5 cm.
63	377	16 cm mud, yellow-brown, interlaminated with 2 mm-thick grey mud layers in lower 13 cm; occasional aggregates grey mud, $\frac{1}{2}$ - 1 mm diameter; 6 cm sandy mud, grey.
		32 cm mud, grey, no apparent bedding; 1 cm-thick bed of quartzose sand, very fine, slightly muddy, at 13 cm from top; 58 cm sandy mud, grey, abundant coarse-grain to granule size, grey, fissile clay fragments throughout; occasional yellow-brown clay fragments; total clay fragments about 1% of matrix.

Core No.	Depth (Metres)	Description (Top to Bottom)
64	374	12 cm sandy mud, yellow-brown, abundant calcareous foraminifera; interlaminated with dark grey mud in layers 1 - 2 cm thick in lower half; 6 cm muddy sand, fine, grey, no apparent bedding.
65	316	6 cm mud, yellow-brown; 1 cm sand, fine, orange-brown; iron oxide-stained 13 cm sandy mud, brown, slightly dark gray mottling in upper 5 cm; base sharp; 91 cm mud, light grey, very finely, flatly, laminated, throughout; laminae 1 mm-5 mm thick; graded bedding, from clay to coarse silt, throughout; color banding, dark grey or purplish to very light grey-white, overall; dark coloured layers generally finest, grading upward to light coloured and coarser layers; dark layers sharp at base; colour bands $\frac{1}{4}$ - $\frac{1}{2}$ cm thick.
66	297	12 cm mud, yellow-brown, abundant calcareous foraminifera; calcareous worm tube, plant debris at surface; 3 cm sand, fine, yellow-brown; frequent fine pebbles grey sandstone.
67	374	19 cm mud, yellow-brown, abundant calcareous foraminifera; irregular, light grey mottling; brown colour banding in lower 10 cm; base sharp; 40 cm sandy mud, grey, no apparent bedding sand fine to medium, quartzose; $\frac{1}{2}$ cm diameter, angular gypsum fragment at 30 cm from top; light brown sandy mud layer at 34-35 cm from top.
68	352	15 cm mud, yellow-brown, slight dark grey mottling in lower 7 cm; few calcareous foraminifera; base sharp 1 cm sand, orange-brown, fine to very fine; closely packed; base sharp. 31 cm sandy mud, grey, no apparent bedding; hematite-red, fissile claystone fragments, $\frac{1}{2}$-1 cm, in upper 2 cm; grey claystone fine pebbles throughout, rare; trace grey sandstone fine pebbles.

Core No.	Depth (Metres)	Description (Top to Bottom)
69	298	15 cm sandy mud, yellow-brown, no apparent structure; abundant calcareous foraminifera; 2 cm muddy sand, yellow-brown, medium to coarse, fairly well sorted; subangular to subround; quartzose.
70	279	13 cm mud, yellow-brown, well-defined grey laminae in lower 6 cm, structureless at top; few calcareous foraminifera; 75 cm mud, dark grey, interlaminated and thinly interbedded with beds of slightly lighter colour throughout; bedding flat; bases of dark layers sharp, grade upward to lighter beds; no visible textural differences; laminae 1 mm - 5 mm, beds 5 mm - 2 cm thick; base sharp; 53 cm muddy, very fine, sand, grey; no apparent bedding few light brown pebbles throughout.
71	452	27 cm mud, yellow-brown, structureless in upper 12 cm; lower 15 cm mottled and streaked with grey mud spots; some slightly lighter coloured mottling, probably burrow fillings; 17 cm mud, dark grey, thin-bedded, flat; some dark and light colour banding, 8 cm from top; slight fine and very fine sand content increases to 10% at base; base transitional 22 cm muddy sand, brown, fine and very fine, frequent fine pebbles; well imbricated but vertically undifferentiated; base sharp; 35 cm sandy mud, dark grey, slightly gravelly; 15% dark grey shale coarse grains and granules; no apparent bedding.
72	336	17 cm mud, yellow-brown, structureless in upper 10 cm; interlaminated with dark grey mud in lower 7 cm; base sharp; 22 cm sandy mud, grey, 30% quartzose, fine sand; massive.

Core No.	Depth (Metres)	Description (Top to Bottom)
73	186	10 cm mud, grey-brown, few laminae of dark grey mud; 3 cm mud, orange-brown, iron oxide-stained, compact; very thin, flat colour banding by slightly lighter laminae; 27 cm mud, grey and dark grey, no apparent layering; mottled irregularly; base sharp; 40 cm mud, grey, becomes slightly sandy at base; sand quartz, fine-very fine; no apparent bedding; base transitional; 35 cm muddy sand, grey, coarse; quartz; subangular to subround; well packed; no apparent bedding; imbricated; base transitional; 8 cm sandy mud, grey, very thinly, flat, bedded; compact; 11 cm muddy sand, grey, medium, fairly well sorted; frequent fine pebbles of grey clay shale.
74	313	16 cm sandy mud, yellow-brown, faint dark grey mottling; 5 cm mud, yellow-brown and grey, interlaminated, flat; laminae 3 mm thick; no apparent textural difference between colours; 141 cm mud, grey, composed of dark grey and light grey layers in cyclical sequence; dark layers grade upward to light layers, which are sharply truncated by dark layers; cycles 2 mm to 2 cm thick; no apparent textural variation.
75	533	19 cm mud, yellow-brown; irregular, grey mottling in lower 10 cm; 41 cm mud, grey, finely laminated; 27 cm sandy mud, grey; massive; 24 cm mud, grey, massive.
76	398	19 cm mud, yellow-brown; 5% fine sand; interlaminated with dark grey mud in lower 3 cm; iron oxide staining in 2 laminae; 88 cm mud, grey, composed of dark grey and light grey layers in cyclical sequence; dark layers grade upward to light layers, which are sharply truncated by dark layers; dark layers very slightly coarser.

Core No.	Depth (Metres)	Description (Top to Bottom)
77	494	30 cm mud, yellow-brown, 10% fine sand in upper 10 cm; interlaminated with grey and iron oxide-stained layers in lower 16 cm; base sharp; 71 cm mud, grey, cyclically layered, layers ½ mm - 1 cm thick; dark layers grade upward to light layers, which are sharply overlain by dark layers. 17 cm muddy sand, grey, few fine pebbles, randomly distributed; sand fine-very fine, round-subround occasional granules grey clay shale.
78	395	11 cm mud, yellow-brown, no apparent bedding; 30 cm mud, light brown, mottled with grey mud; interbedded with dark grey mud containing granules and fine pebbles of grey shale; 1 cm thick grey layer at 6 cm from top; 4 cm thick layer at 15 cm from top; very fine, flat laminated structures visible throughout unit; base transitional; 44 cm mud, dark grey, finely interlaminated with light brown mud; cyclical sequence of dark layers grading upward to light layers, which are overlain sharply by dark layers; ½ cm thick layer of very fine, clean white sand at 30 cm from top.
79	188	7 cm sandy mud, yellow-brown; frequent blebs of iron oxide staining; base transitional; 88 cm sandy mud, dark grey, slightly gravelly; dry and compact; no apparent bedding; shale, limestone, and metamorphic rock granules throughout; frequent fine pebbles of same composition.
80	416	20 cm mud, yellow-brown, uniform, no apparent bedding; very faint grey mottling, as of disrupted bedding, in lower 2 cm;

Core No.	Depth (Metres)	Description (Top to Bottom)
80	416	10 cm mud, grey-brown; grey mottling in upper 3-4 cm becomes irregular bedding in lower part; laminae 2-3 mm thick; laminae are alternately grey and brown but do not grade into one another; unit is transitional between one above and one below; 30 cm mud, light grey, well defined laminae in cyclical sequence of darker layers grading upward to lighter layers, which are sharply overlain by darker layers; layers at base thinner and more closely spaced (1-2mm) than at top (3-4mm); 13 cm muddy sand, grey, quartzose; fine, sand graction well sorted; very fine sandy mud in top 5 cm.