

DEPARTMENT OF ENERGY, MINES AND RESOURCES

Geological Survey of Canada



SURFICIAL MATERIAL SOUTH CENTRAL  
ELLESMERE ISLAND NORTHWEST TERRITORIES

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LEGEND: VENDOM FIORD (49D) AND STRATHCONA FIORD (49E)






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1. Precambrian rock and residual rock
  2. Carbonate and calcareous clastic rock (Paleozoic)
    - a. Generally resistant, high relief
    - b. Generally recessive, moderate relief
  3. Clastic, minor calcareous, rock (Phanerozoic)
    - a. Coarse-grained generally resistant clastic rock
    - b. Fine-grained recessive and resistant clastic rock
    - c. Fine- and coarse-grained recessive rock
  4. Plateau gravel
  5. Morainal deposits
    - a. Undifferentiated till
    - b. Fine-grained 'Strathcona Fiord' till
    - c. Coarse-grained Holocene advance till
    - d. Neoglacial moraines
    - e. Complex of morainal, fluvio-glacial and rock units (indivisible at map scale)
  6. Marine sediment
    - a. Marine-washed rock
    - b. Fine-grained marine sediment
    - c. Relict coarse-grained beaches
  7. Delta sediment
    - a. Coarse-grained relict proglacial delta sediment
    - b. Coarse/fine-grained inactive delta sediment
    - c. Coarse-grained active delta sediment - nival regime
    - d. Coarse-grained active delta sediment - glacial regime
  8. Fluvial sediment - coarse grained
    - a. Relict valley train sediment
    - b. Fluvial terrace and inactive fan sediment
    - c. Active valley flat and fan sediment - nival regime
    - d. Active valley train sediment - glacial regime
  9. Fluvial sediment - fine grained
    - a. Fluvial terrace sediment
    - b. Active valley flat sediment
  10. Colluvium
- Ice

SYMBOLS

-  Geological boundary (position defined, approximate, assumed/gradational)
-  Tie line, linking units with same designation
-  Link in complex unit
-  Glacially scoured rock

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-  Glacial meltwater channel
-  Moraine ridge
-  Glacial striae
-  Rock glacier
-  Pingo

EXPANDED LEGEND: VENDOM FIORD (49D) AND STRATHCONA FIORD (49E)

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Notes:

Materials: 'Fines' defined as clay to fine sand size material (i.e. <0.25 mm).

Topography:

<u>slope inclination:</u>	<u>degrees</u>	<u>description</u>
	0-1	level
	1-3	gentle
	3-15	moderate
	15-35	steep
	>35	cliffed

Sensitivity, Hazardousness and Trafficability ratings are tabulated at the end.

UNIT 1: PRECAMBRIAN ROCK AND RESIDUAL ROCK.

Material. Gneiss, granite, migmatite; generally covered by ca. 1 m of bouldery rubble to sand size weathered rock. Minor outcrop. Resistant.

Topography. Rugged relief where exposed through ice. Moderate to steep slopes, numerous cliffs. Elevations of nunataks may exceed 2000 m.

Drainage. Well drained. Main valleys drain ice caps.

Processes. Rockfall, debris chutes, frost riving, talus creep, solifluction lobes, gullyng.

Thermal Regime. No data.

Vegetation. Sparse or none.

UNIT 2: CARBONATE AND CALCAREOUS CLASTIC ROCK (PALEOZOIC)

2a - Generally resistant, high relief

Material. Limestone, dolomite; minor conglomerate, siltstone, shale; generally resistant, though lesser to minor recessive intervals. Includes all Cambrian and Lower Ordovician formations except Baumann Fiord Formation; plus Eneanor River, Bay Fiord (though commonly recessive, outcrop area is small), Thumb Mountain, Irene Bay, Allen Bay, Read Bay, resistant units of Cape Phillips, and Blue Fiord formations.

Weathers to boulder to gravel size rubble, lesser interstitial sand and fines; some discrete areas dominantly sand or fines. May incorporate minor to major quantities of undifferentiated morainal material (see 5a). Residual cover scattered to continuous; few cm to 1 m thick.

Topography

a) 49E, 49D/N $\frac{1}{2}$ . Mountain ranges and ridges, chains of hills, trending NNE. Local relief generally rugged, commonly 100-500 m; maximum elevations 1000m. Many hogsback ridges and major to minor scarps. Steep slopes and cliffs widespread, but also numerous gentle to moderate slope facets.

b) 49D/S $\frac{1}{2}$ . Areas of landforms as above, but also extensive low rolling plateau, deeply dissected by fluvial and glacial processes.

Drainage. Generally well drained, locally poorly drained on gentle slopes, at foot of long slopes, or downslope from perennial snowbanks. Snowmelt period not synchronous over unit due to diverse topography.

Processes. Rockfall, debris chutes, talus creep, rare rock glaciers; frost riving; cryoturbation where residual fines present, solifluction lobes; rilling and slopewash on gentle slopes.

Thermal Regime. Active layer thickness 50-100 cm. Interstitial ice in rubble, but ice content generally <10%.

Vegetation. Sparse to none.

2b - Generally recessive, moderate relief

Material. Shale, siltstone, lesser to minor limestone, dolomite, anhydrite, gypsum. Includes Baumann Fiord, Cape Phillips and Eids formations, and any extensive outcrop of recessive intervals of unit 2a formations.

Weathers to gravel size or smaller shale and siltstone fragments, and fines dominantly silt size. Thickness 0-2 m. Minor outcrop. Glacial erratics from units 1, 2a and 4 locally numerous.

Topography. Variety of terrain, including: long moderate slopes within unit 2a; highly dissected ridges and valleys adjacent to 2a, local relief to 500 m; low rolling locally dissected plateau (especially Eids Formation).

Drainage. Steep slopes well drained. Moderate and gentle slopes poorly drained at snowmelt, moderately well to poorly drained in summer. Numerous rills and runnels; gullying common on Eids Formation.

Processes. Fluvial and slow mass movement dominant: rills, runnels, gullies; solifluction on moderate slopes. As 2a on steep slopes.

Thermal Regime. Active layer thickness 30-100 cm. Little data on ice content, but probably 10-50% under most poorly drained slopes. Frost fissures (ice filled) common on level to gently inclined areas.

Vegetation. Sparse to moderate.

UNIT 3: CLASTIC, MINOR CALCAREOUS, ROCK (PHANEROZOIC).

3a - Coarse-grained generally resistant clastic rock.

Material. Sandstone (in part calcareous), siltstone, minor conglomerate and shale; of Vendom Fiord, Okse Bay (part), Bjerne, Schei Point, Isachsen and Hassel formations.

Weathers to rubble, coarse to fine sand, minor silt and clay.

Topography. Rugged relief: commonly flanks unit 2a mountain chains in 49E; independent massifs in 49D, especially S $\frac{1}{2}$ , to 1000 m elevation. Local relief 50-500 m. Slopes gentle to steep; numerous cliffed segments.

Drainage. Rubble generally well drained. Sand and fines moderately to poorly drained, especially on gentle slopes.

Processes. Thermal Regime. As 2a.

Vegetation. Sparse

3b - Fine-grained recessive and resistant clastic rock

Material. Shale, siltstone, minor sandstone; of Okse Bay (part), Christopher and Kanguk formations. Weathers to fines, platy shale and siltstone fragments.

Topography. Includes: low to moderate slopes on low rolling terrain, local relief 20-100 m; long (to 3km) gentle to moderate slopes, especially on Okse Bay Formation; and moderate slopes to cliffs in highly dissected terrain.

Drainage. Steep slopes moderately well to well drained. Gentle and moderate slopes poorly drained during snowmelt, moderately well to poorly drained in summer.

Processes. Fluvial and slow mass movement dominant: rills, runnels, gullies; solifluction lobes less prominent than on coarser material.

Thermal Regime. No data. Probably moderate (to 50%) ice content under rills.

Vegetation. Sparse to abundant. Complete cover (chiefly moss/lichen) in rill and runnel channels.

3c - Fine- and coarse-grained recessive rock.

Material. Sandstone, siltstone, shale, minor conglomerate and coal, of the Eureka Sound Formation. Level to moderately inclined non- to poorly-lithified strata.

Weathers to fines (dominantly fine sand and coarse silt) and minor sandstone and siltstone rubble.



Topography. Gently to steeply inclined slopes, developed by dissection of peneplain cut across Eureka Sound Formation. Surface variable from smooth to succession of minor scarps to 20 m high.

Drainage. Poorly drained in snowmelt, moderately-well drained in summer. Close-spaced rills and runnels.

Processes. Fluvial and mass movement dominant: rills, gullies; solifluction lobes common. Some rockfall on steep slopes. Frost fissures where mass movement not active.

Vegetation. See 3b.

#### UNIT 4: PLATEAU GRAVEL

Material. Bouldery gravel, sand, fine sand and silt; minor peat layers; intermixed or in discrete units, though surface layers normally gravel. Thickness up to 100 m; generally at least 5 m. Boulders subangular to round granite, carbonate, quartzite, sandstone. Excluding margins and smaller residuals, This unit is commonly overlain by finer-grained material, probably morainal (unit 5), possible weathered gravel. Peat in poorly drained depressions is rarely >25 cm thick. Fluvial channels are boulders or gravel. Colluvium (unit 10) on slopes leading away from plateau gravel is chiefly gravel sand and silt veneer or discontinuous cover over rock or gravel.

Topography. Chiefly level to low rolling plateau at 150 to 500 m altitude. Some mesa-like plateau remnants.

Drainage. Drainage poor during snowmelt; surface material strength weak, as even gravel is saturated. Drainage in summer moderately good, but poor in depressions. Lakes and ponds over 5% of unit. Small plateau residuals and margins of larger areas generally well drained. Main drainage lines rarely incised; channels are wide.

Processes. Chiefly fluvial: rills and shallow runnels. Little mass movement. Frost fissures are widespread, and ponding in fissure troughs commonly leads to thermokarst enlargement.

Thermal Regime. Active layer maximum thickness: 60 to 100 cm on well-drained sand and gravel; 30-50 cm on silty gravel and sand; 10-30 cm under poorly drained peaty depressions. Frost fissures probably ice filled. Palsas are common in ponds; scattered pingo-like mounds present.

Origin. Late Tertiary or early Pleistocene fluvial sediment sheet deposited on a peneplain truncating underlying rocks (especially Eureka Sound Formation).

Vegetation. Abundant moss/lichen cover, fewer vascular plants (willow common). Sparse cover on well-drained plateau margins.

## UNIT 5: MORAINAL DEPOSITS

### 5a - Undifferentiated till

Material. Dominantly gravelly bouldery sand or silt; greatly influenced by underlying sediments. Over plateau gravels (unit 4), generally >50% sand plus granite, carbonate and sandstone gravel and boulders; thickness >1 m. Over resistant rocks (units 2a, 3a), carbonate and sandstone boulders and rubble dominant, but also much granite, plus silt or sand matrix; thickness <1 to 5 m. Over recessive rocks (units 2b, 3b, 3c), dominantly silt, carbonate and sandstone rubble, shale fragments, and granite; thickness <1 to 5 m. Boulders commonly round to subangular, derived from plateau gravel.

Topography, Drainage, etc. See underlying units. Frost fissure troughs widespread; commonly deep and wide on thick deposits.

Origin. Probably ablation till. Age undetermined; includes material of Holocene, late Pleistocene and possibly older age.

### 5b - Fine-grained 'Strathcona Fiord' till

Material. Gravelly fines or sand, >1 m thick possibly >10 m, commonly overlain by marine sediment.

Topography. Extensive level areas, some gentle and moderate slopes, generally between 0 and 200 m altitude.

Drainage. Poor at snowmelt, poor to moderately good in summer. Many frost fissure trough ponds on level areas.

Processes. Wide, deep frost fissure troughs over much of unit. Scattered flowslides on slopes.

Thermal Regime. Frost fissures probably ice filled; possibly high segregated ice content in fine-grained material.

Origin. Morainal (glaciomarine?) deposit from ice occupying Strathcona Fiord and inner Bay Fiord, possibly in early Holocene.

Vegetation. No data.

### 5c - Coarse-grained Holocene advance till

Material. Sandy bouldery gravel; some thick sand beds in terminal moraines. Gravel and boulders dominantly granite, gneiss, carbonates. Thickness <1 m to >20 m.

Topography. Discontinuous veneer over irregular topography of glacially scoured bedrock units (1, 2, 3). Lateral and terminal moraine ridges to 20 m high.

Drainage. Generally well drained, but some impeded drainage and ponding in meltwater drainage channels.

Processes. Frost fissures widespread in thicker till.

Thermal Regime. No data.

Origin. Ice advance or readvance of early Holocene age. Possible 'Strathcona Fiord' till and morainal deposits flanking Vendom Fiord are from an earlier phase of this episode.

Vegetation. No data.

5d - Neoglacial moraines

General comment. Unstable sandy silty bouldery gravel, ice-cored, at modern ice margins.

5e - Complex of morainal, fluvio-glacial and rock units (indivisible at map scale).

Material. Silty or sandy gravel, chiefly morainal deposits of 5a or 5c; plus rock of 2a, b, 3a, b.

Topography. Overall gentle to steep slopes, on which are superimposed steep-sided moraine ridges and kames and rockcut channels (relief to 20 m).

Drainage, Processes, etc. As underlying sediment.

Origin. Marginal ice contact valley glacier landforms, probably of early Holocene age.

## UNIT 6: MARINE SEDIMENT

General Comment. Maximum Holocene sea level ca. 80 m in inner fiords, >100 m in outer (western) fiords.

### 6a - Marine-washed rock

Material. Marine planed and washed rock (chiefly 3c) and discontinuous marine sediment veneer. Commonly clay to fine sand, minor gravel.

Topography. Level to gently inclined; locally dissected; 0-100 m altitude.

Drainage. Poor during snowmelt, poor to moderately-good in summer.

Processes. Chiefly fluvial: rills, runnels. Slope failures common on stream banks. Frost fissures widespread.

Thermal Regime. Frost fissures ice-filled; probably 10-50% segregated ice elsewhere.

Origin. Planation dates from one or more lengthy marine inundations during Pleistocene. Sediments are of Holocene age.

Vegetation. No data.

### 6b - Fine-grained marine sediment

Material. Clay to fine sand, 1 to >10 m thick.

Topography. Level to moderately inclined; slopes commonly highly dissected by gullies.

Drainage. Poor during snowmelt, poor to moderately- good in summer. Ponding on level areas.

Processes. Chiefly fluvial: rills, gullies.

Thermal Regime. Probably 10-50% segregated ice.

Origin. Marine nearshore and offshore sediment deposited when Holocene sea level higher. Unit commonly underlies coarse-grained beaches and delta topsets and foresets.

Vegetation. None to sparse.

### 6c - Relict coarse-grained beaches

Material. Sandy gravel and rubble beach berms and swales. Gravel of carbonate, sandstone, granite, platy shale and siltstone fragments; 1 to 5 m thick; commonly underlain by unit 6b.

Topography. Overall gentle to moderate slopes, 0-100 m elevation. Microrelief composed of berms and swales commonly 10 to 50 cm high, 1 to 5 m amplitude.

Drainage. Well drained, except some ponding in swales where overall slope gentle.

Processes. Solifluction lobes on steep slopes or where upslope colluvium encroaches on beach. Frost fissures common; trough rims may rise 1 m above wide troughs.

Thermal Regime. Active layer thickness 60-100 cm. Little ice in beach sediments, but underlying fines ice-rich.

Origin. Shoreline sediments from higher Holocene sea level.

UNIT 7: DELTA SEDIMENT

7a - Coarse-grained relict proglacial delta sediment

Material. Sandy or silty bouldery gravel, nonsorted to X-bedded, 1-20 m thick; may be underlain by fine-grained marine sediments.

Topography. Overall level surface, bounded by steep slopes on downvalley side. Top surface may be pitted and include kettle-holes to several hundred metres in diameter.

Drainage. Well drained.

Processes. Frost fissures widespread on level surfaces; trough rims may rise 1 m above troughs 5 m wide.

Thermal Regime. Frost fissures probably ice filled where projecting into underlying fines; otherwise partial or no ice filling. Low or no segregated ice elsewhere.

Origin. Ice-contact, valley train or spillway deposits developed at high Holocene sea level.

7b - Coarse over fine-grained inactive delta sediment

Material. Sand, gravel, silt, minor peaty strata; interbedded to massive, sometimes X-bedded; 1-20 m thick. Commonly underlain by fine-grained marine bottomsets.

Topography. Level to gently inclined surface, bounded by steep slopes 1-20 m high on down valley side. May be only one surface, or numerous 'steps'.

Drainage, Processes, Thermal Regime. As 7a.

Origin. Delta surface abandoned due to relative fall in Holocene sea level. Commonly dissected by later channels.

7c - Active delta sediment, dominantly coarse grained: nival regime

Material. Chiefly sand and gravel, proportion depending on source materials in drainage basin. Sediment in marginal and nearshore quiet-water may be fine grained.

Topography. One or more shifting main channels incised 1-2 m into valley flat.

Drainage, Processes. Peak discharge during snowmelt; secondary peaks during or after prolonged or heavy rainfall.

Thermal Regime. No data.

Origin. Developed at modern shoreline by discharge of snowmelt and rain runoff.

7d - Active delta sediment, dominantly coarse grained: glacial regime

Material. See 7c, though material commonly coarser, including large proportion of boulders.

Drainage, Processes. High discharge maintained after snowmelt, through ice-cap ablation period (i.e. much of summer). Discharge varies diurnally and with weather (as in nival regime delta during snowmelt). Risk of jokelhaup, particularly at head of Vendom Fiord.

Origin. Developed at modern shoreline by discharge from ablating ice, plus snowmelt and rain.



UNIT 8: FLUVIAL SEDIMENT - COARSE GRAINED

General Comment. Only deposits wider than 100 m mapped. Though bedload is dependent on source materials in a drainage basin, the coarser fraction is commonly dominant. As plateau gravel or morainal deposits are present in most large drainage basins, gravel and boulders occur in fluvial sediment even where bedrock is fine grained.

8a - Relict valley train sediment

Material. Sandy or silty bouldery gravel; thickness >10 m.

Topography etc. As 7a.

Origin. Valley train from early Holocene ice margin.

8b - Fluvial terrace and inactive fan sediment

Material. Sand, gravel, boulders, minor fines; sand or gravel may be dominant, or both interbedded. Thickness 2 to >10 m.

Topography. One or more overall level to gently inclined terrace surfaces bounded by steep slopes 1-20 m high.

Drainage, Processes, Thermal Regime. As 7a.

8c - Active valley flat and fan sediment - nival regime

Material. As 8b.

Topography. Main anastomosing channels incised 1-2 m into valley flat.

Drainage, Processes, Thermal Regime. As 7c.

8d - Active valley train sediment-glacial regime

Material. Gravel, boulders, lesser sand, minor fines.

Topography. As 8c, though valley flats commonly very wide.

Drainage, Processes, Thermal Regime. As 7d.

UNIT 9: FLUVIAL SEDIMENT-FINE GRAINED

General Comment. As unit 8.

9a - Fluvial terrace sediment

Material. Fine sand to clay, minor interbedded gravel or coarse sand.

Topography. As 8b.

Drainage. Moderately well drained if inclined, poorly drained if level.  
May remain moist or saturated and quick after snowmelt.

Processes. Banks may be subject to earthflows.

9b - Active valley flat sediment

Material. As 9a. May be quick if moist or saturated.

UNIT 10: COLLUVIUM

Material. Variable from bouldery gravel to fines - refer to upslope unit, or if veneer, to underlying unit, for indication of composition.

Topography. Chiefly long (>1 km ) moderate or steep slopes.

Drainage. Upper slopes commonly well drained after snowmelt; lower slopes and especially the slope foot can remain poorly drained through the summer.

Processes. Fluvial processes and slow mass movement dominant. Close-spaced rills and runnels; solifluction lobes widespread, especially on coarser material.

Thermal Regime. Ice-filled frost fissures widespread, even where solifluction occurs. Ice content elsewhere probably 25-50%.

Origin. Colluvium defined here as material displaced or altered by rilling or mass movement to such a degree that it markedly differs in composition or structure from adjacent or subjacent source material. Most material on slopes is not mapped as colluvium, as either it is too small in extent to be mapped, or no significant difference from the source material is apparent.

UNIT-Ice

General Comment. Includes glacial ice of central and southern Ellesmere Island ice caps, and glacierets. Outlet glaciers from larger ice caps may extend well below equilibrium level.

Topography. Overall surface is gently contoured, except where rugged nunataks of unit 1 project through. Macro and microrelief in the ablation zone in summer is less even; supra-glacial streams are incised, and crevasse are present on outlet glaciers. Ice margins are generally steep.

UNIT	SENSITIVITY			HAZARDOUSNESS			TRAFFICABILITY	
	Magnitude	Form		Magnitude	Form		Roughness	Traction
1	low			high		s	D	T
2a	low			mod./high		s	D	T
2b	moderate	d	s	moderate	d	s	T/D	T/D*
3a	low			moderate		s	D	T
3b	moderate	d	t s	moderate		t s	T/D	T/D*
3c	moderate	d	t s	moderate		t s	T/D	T/D*
4	moderate	d	t	low		t	T	T/D*
5a	low/mod.	d	t	moderate	d	t	T	T/D*
5b	moderate	d	t s	moderate		t s	T/D	T/D*
5c	low			low			T/D	T
5d	high		t s	high		t s	D	T/D
5e	low			low			D	T
6a	moderate	d	t	moderate	d	t s	T	T/D*
6b	high	d	t	moderate	d	t	T/D	T/D*
6c	low			low			T	T
7a	low		t	low		t	T/D	T
7b	low		t	low		t	T/D	T
7c	low			high	d		T	T*
7d	low			(very) high	d		T	T
8a	low		t	low		t	T/D	T
8b	low		t	low		t	T/D	T*
8c	low			high	d		T	T*
8d	low			(very) high	d		T	T
9a	moderate		t s	moderate		t s	T/D	T/D*
9b	moderate	d		high	d		T	T/D*
10	moderate	d	t s	moderate	d	t s	T/D	T/D*
Ice							T/D	

Sensitivity, hazardousness and trafficability ratings

Sensitivity: Magnitude: low; moderate, high.

Form: d = drainage disruption; t = thermal erosion; s = slope failure.

Hazardousness: d = fluvial disturbance; t = thermal disturbance; s = slope failure;

Trafficability: Roughness, Traction: T = traversible; T/D = traversible with some difficulty; D = difficult or impassible. Asterisk\* = higher rating during snowmelt or heavy rain.

UNIT	SENSITIVITY			HAZARDOUSNESS			TRAFFICABILITY	
	Magnitude	Form		Magnitude	Form		Roughness	Traction
1	low			high		s	D	T
2a	low			mod./high		s	D	T
2b	moderate	d	s	moderate	d	s	T/D	T/D*
3a	low			moderate		s	D	T
3b	moderate	d	t s	moderate		t s	T/D	T/D*
3c	moderate	d	t s	moderate		t s	T/D	T/D*
4	moderate	d	t	low		t	T	T/D*
5a	low/mod.	d	t	moderate	d	t	T	T/D*
5b	moderate	d	t s	moderate		t s	T/D	T/D*
5c	low			low			T/D	T
5d	high		t s	high		t s	D	T/D
5e	low			low			D	T
6a	moderate	d	t	moderate	d	t s	T	T/D*
6b	high	d	t	moderate	d	t	T/D	T/D*
6c	low			low			T	T
7a	low		t	low		t	T/D	T
7b	low		t	low		t	T/D	T
7c	low			high	d		T	T*
7d	low			(very) high	d		T	T
8a	low		t	low		t	T/D	T
8b	low		t	low		t	T/D	T*
8c	low			high	d		T	T*
8d	low			(very) high	d		T	T
9a	moderate		t s	moderate		t s	T/D	T/D*
9b	moderate	d		high	d		T	T/D*
10	moderate	d	t s	moderate	d	t s	T/D	T/D*
Ice							T/D	

Sensitivity, hazardousness and trafficability ratings

Sensitivity: Magnitude: low; moderate, high.

Form: d = drainage disruption; t = thermal erosion; s = slope failure.

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