**CANADIAN GEOSCIENCE MAP 320** 

This map presents the surficial geology and landslide inventory covering the headwaters of Hoult Creek, across Nimbus Mountain, and following sections of the main valleys and tributaries of Clore and Burnie rivers. The mapped area extends for a distance of about 22 km. The topography mainly features relatively narrow valleys confined by moderate to steep side slopes, and includes the alpine area around Nimbus Mountain and the very steeply entrenched canyon of Clore River. The highest elevation in this map area is 2280 m southeast of Nimbus Mountain. Surficial geology compilation was carried out following the Geological Survey of Canada Surficial Data Model (Deblonde et al., 2017) combined with the British Columbia Terrain Classification System (Howes and Kenk, 1997). The map is one of five surficial geology maps that cover the corridor from Kitimat, British Columbia at the head of Douglas Channel to the Morice River area at the western edge of the Interior Plateau.

The main objective of the surficial geology compilation is to provide baseline information on surface sediments and slope processes for stakeholders and decision-makers. In addition to the surficial geology, the authors have compiled information about landslides that were observed in the map area (Table 1) The surficial geology consists of colluvium- and bedrock-dominated ridge crests, and valley slopes with valley floors and lower slopes mantled by thin to relatively thick deposits of mainly till and glaciofluvial sediments. Bedrock-dominated errain predominates the area around Nimbus Mountain, and along the ridge and scarp bordering the canyon area of Clore River. Small alpine glaciers remain on Nimbus Mountain, bordered by small, neoglacial moraines. In places along the valley floors, modern alluvial fans, terraces, and floodplains, and colluvial fans are superimposed on the older glacial The bedrock polygons have been labelled R2, indicating dominantly hard, unaltered igneous rocks (granitic, gneissic,

and volcanic) and R, indicating an apparently softer and highly altered and fractured bedrock, likely consisting mainly of

clastic volcanic, based on available bedrock geology maps (MacIntyre et al., 1994). The latter rock type occurs along the canyon of Clore River and on the ridge to its south. Interpretation of landslides was carried out using Cruden and Varnes' (1996) classification. Mapped landslide deposits and landslide tracks without mappable deposits were compiled in Table 1. A variety of mapped landslide deposits are scattered throughout this map area. On sections of the valley walls, there are areas of undifferentiated landslide debris (unit Cz) and active talus slopes (unit Ca) that occur beneath rockfall-prone bedrock cliffs. Some toeslope sites also have larger accumulations of talus (unit Ca), as well as deposits from smaller, shallow-seated translational landslides (unit Cz5). Valley-floor and gentler toe-slope areas below steep-gradient gullies, are common sites for colluvial fan deposits, both generally inactive fans (unit Cf) and those subject to recent and/or recurrent debrisflow activity (units Cz2 and Cf.Cz2). Relict rock-avalanche deposits (unit Cz1) are mapped in a couple of places along the floors of Clore River tributaries. Other colluvial units (e.g. Cv = colluvial veneer, Cb = colluvial blanket, C = undifferentiated colluvium) were included in Table 1 because they commonly contain small, unmappable areas of landslide deposits associated with small, shallow-seated translational slides. These slides are depicted on the map with arrows and include debris slides and flows consisting predominantly of mineral material, small rockslide and rockfalls, Terrain stability mapping was also carried out for the map area following the method described by British Columba

Ministry of Forests (1999) for the Forest Practices Code of British Columbia. Although this method was developed for the forestry sector, it has been used in assessing terrain stability for environmental assessments for resource development projects, such as mining and wind farms in British Columbia and Yukon. Terrain stability mapping is intended to qualitatively highlight the potential landslide sources based on slope gradient, surficial materials, material texture, material thickness, slope morphology, moisture conditions, and ongoing geomorphic processes (British Columbia Ministry of Forests, 1999). Terrain polygons were rated as stable to unstable (Class I-V, respectively) and colour coded from green to red, respectively (Fig. 1). In some cases, two adjacent surficial geology polygons have the same map label, e.g. unit Cv. They were not joined as a single polygon because the two units were rated differently in terms of terrain stability. The reader has the option to generate a terrain stability map from the downloadable data set associated with this map area.

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Resources, Open File 1994-14, scale 1:250 000.

Columbia (NTS 93 E, L, M; 94D; 103 G, H, I, J, O, P; 104 A, B); B.C. Ministry of Energy, Mines and Petroleum

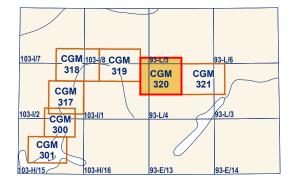
Table 1. Compilation of the types of colluvial deposits (C) in the map area, either associated with a landslide process, which include smaller events that are indicated by arrows, or deposits that are not specifically tied to a landslide process (i.e. colluvial blanket and veneer).

Unit	Description	No. of occurrences
	Landslide deposits and tracks	
Cf; Cf.Cz2; Cz2	Fan sediments deposited by debris flows	15
Ca	Apron and cone talus scree deposits derived from rockfall	52
Cz1	Landslide deposits derived from relict rock avalanches	2
Cz5	Landslide deposits associated with shallow, translational sliding from bedrock headwalls	3
Cz	Landslide deposits: undifferentiated, relict to recent bedrock slumps, slides, falls, topples, and/or spreads	1
	Sediment transport direction	559
	Colluvial deposits	
Cv	Veneer derived from underlying weathered bedrock	249
Cb	Blanket derived from underlying weathered bedrock	53
С	Variable thickness, undifferentiated deposits derived from underlying weathered bedrock and/or small mass movements	5

The 105 km long Kitimat–Morice River corridor features mostly interconnecting valleys linking the coastal community of Kitimat in northwestern British Columbia with the interior valley system of Morice River. The Nimbus Mountain and Clore River canyon map area covers a distance of about 22 km from the headwaters of Hoult Creek, across Nimbus Mountain, and then following sections of Clore River valley to just past its confluence with Burnie River. Mapping of surficial sediments, compilation of landslide deposits, and preliminary interpretation of bedrock types were primarily carried out using 1:20 000 British Columbia government aerial photographs dated from 2001 (west half of corridor in NTS 103-I) and 2013 (east half of corridor in NTS 93-L). Older, field-based mapping by the authors in some parts of the study area was incorporated into this mapping, complemented with additional reconnaissance-level field observation in

Le corridor Kitimat-rivière Morice, d'une longueur de 105 km, comprend principalement des vallées interconnectées reliant la communauté côtière de Kitimat, dans le nord-ouest de la Colombie-Britannique, au système intérieur de la vallée de la rivière Morice. La région cartographique de Nimbus Mountain and Clore River canvon couvre une distance d'environ 22 km à partir de la confluence des rivières Clore et Burnie, en remontant des sections de la vallée de la rivière Clore, pour se terminer à la source du ruisseau Hoult, de l'autre côté du mont Nimbus. La cartographie des sédiments de surface, la compilation des dépôts de glissements de terrain et l'interprétation préliminaire des types de substratum rocheux ont principalement été datées de 2001 (moitié ouest du corridor dans SNRC 103-I) et de 2013 (moitié est du corridor dans SNRC 93-L). Les résultats d'une cartographie antérieure réalisée sur le terrain par les auteurs dans certaines parties de la zone d'étude ont été intégrés à la présente cartographie, qui a été complétée par des observations

de terrain d'un levé de reconnaissance en 2016.



National Topographic System reference and index to adjoining published Geological Survey of Canada maps

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**CANADIAN GEOSCIENCE MAP 320 SURFICIAL GEOLOGY** NIMBUS MOUNTAIN AND **CLORE RIVER CANYON** 

Kitimat-Morice River corridor, British Columbia parts of NTS 103-I/1, 93-L/4 and 5 1:25 000



Authors: D.E. Maynard, I.C. Weiland, **Geological Survey of Canada** and A. Blais-Stevens **Canadian Geoscience Maps** Geology by D.E. Maynard (Denny Maynard & Associates Ltd.), I.C. Weiland (Consultant in Terrain Sciences), and A. Blais-Stevens (Geological Survey of Canada), 2016 Geology conforms to Surficial Data Model v. 2.3.0 (Deblonde et al., 2017). Geomatics and cartography by W. Chow, M. Tougas, and

Joint initiative of the Geological Survey of Canada and the Program of Energy Research and Development (PERD 1D00.006) as part of the Public Safety Geoscience Program Map projection Universal Transverse Mercator, zone 9

North American Datum 1983

Base map at the scale of 1:50 000 from Natural

Resources Canada, with modifications

Contour lines generated from Canadian Digital

Elevation Model (CDEM) supplied by

Natural Resources Canada.

Elevations in metres above mean sea level

C.L. Wagner

Scientific editing by E. Inglis

**SURFICIAL GEOLOGY NIMBUS MOUNTAIN AND CLORE RIVER CANYON** Kitimat-Morice River corridor, British Columbia parts of NTS 103-I/1, 93-L/4 and 5 1:25 000

Shaded-relief image derived from the Canadian Digital Elevation Model (CDEM) supplied by Natural Resources Canada Illumination: azimuth 315°, altitude 45°, vertical factor 1x Magnetic declination 2019, 17°40'E, decreasing 13.4' annually This map is not to be used for navigational purposes. Title photograph: Southeasterly view of the headwaters of

Hoult Creek and Nimbus Mountain, Kitimat–Morice

corridor, northeast of Kitimat, British Columbia.

Photograph by D. Maynard. 2017-101

The Geological Survey of Canada welcomes corrections or additional information from users. Data may include additional observations not portrayed on this map. See map info document accompanying the downloaded data for more information about this publication. This publication is available for free download through GEOSCAN (https://geoscan.nrcan.gc.ca/).

NONGLACIAL ENVIRONMENT ORGANIC DEPOSITS: accumulations of plant material in various stages of decomposition; typically 1–3 m thick, forming fens and bogs in wetlands; folic material greater than 10 cm thick over bedrock in upland locations; organic deposits too small to be shown at this scale Organic veneer: peat, decomposing plant material, and muck in a freshwater wetland; less than 2 m thick; may have somewhat discontinuous coverage. Organic blanket: peat, decomposing plant material, and muck in a freshwater wetland; usually greater than 2 m thick with continuous coverage of the underlying mineral soil. Folic material, undifferentiated: upland organic material of forest origin (leaf litter, twigs, branches, mosses, and muck) accumulated directly over bedrock; greater than 10 cm thick; more than 40 cm thick overlying till; occurring on upland and sloping locations in cool, moist,and humid forest ecosystems; rarely saturated with water; prone to debris slides and debris avalanches when disturbed or when saturated during intense COLLUVIAL AND MASS-WASTING DEPOSITS: diamicton and rubble; nonsorted to poorly sorted; massive to moderately stratified; accumulated from gravity-induced movement or various mass-wasting processes, ranging from slope wash to large landslides; composition dependent on source materials and type of depositional process. Colluvial fan sediments: diamicton and rubble; variable thickness; may contain organics; may be moderately stratified; accumulated as a fan or cone at the mouth of a steep-gradient stream or gully from debris slides and flows, debris floods, and/or snow avalanches; generally not subject to any recent or recurrent activity. Colluvial apron or talus scree: rubble and block accumulations; 1–10 m thick; massive; forming aprons and cones at the base of steep (greater than 40°) slopes; often accumulated due to rockfall and/or small rockslides. Landslide deposits, avalanche: rubble and block fragments of bedrock; forming hummocky accumulations on lower slopes and valley floors; derived from large, relict rock avalanches; generally 2 m to more than Landslide deposits, debris flow: diamicton consisting of a mixture of fine material (sand, silt, clay) and coarse material (gravel, rubble, blocks): deposited in a debris-charged slurry on toe-slope fans, usually at the base of steep-gradient gullies; refers to recent and/or recurrent activity; variable thickness, but commonly greater than 2 m thick. Landslide deposits, translational landslide: rubble and block fragments of bedrock accumulated on lower and toe-slope positions from shallow slides originating on bedrock headwalls; variable thickness, 1–3 m common. Landslide debris, undifferentiated: rubble and block fragments of detached bedrock that occur on benched to steep valley sideslopes; derived from mainly dormant to relict bedrock slumps, slides, falls, topples, and/or spreads; may include small areas of active rockfall and/or slides: variable thickness. Colluvial veneer: diamicton and rubble; less than 2 m thick; mainly derived from disintegration of upslope bedrock on moderate to steep slopes; strongly conforms to the surface expression of the underlying **Colluvial blanket:** diamicton and rubble; 2–5 m thick; mainly derived from disintegration of upslope bedrock on moderate to steep slopes; typically conforms to the surface expression of the underlying landform and may include smaller deposits of unconsolidated debris at the toe of minor landslide and snow-avalanche tracks. Colluvial deposits, undifferentiated: diamicton and rubble accumulated from slow gravity-induced movement and/or various, smaller mass-movement processes; commonly 1–3 m thick where forming a surface mantle, but thicker (greater than 3 m) where exposed on I - No significant problems exist ALLUVIAL (FLUVIAL) SEDIMENTS: gravel and sand with minor silt; commonly stratified; generally well sorted except in alluvial fans; deposited by modern streams. II - Low likelihood of landslide initiation Floodplain sediments: usually sandy, gravelly deposits; 1–5 m thick; forming flat to gently sloping surfaces adjacent to stream and river level; prone to flooding; larger, low-gradient channels are often bordered III - Minor likelihood of landslide initiation by low surfaces mantled by overbank sand, silt, and organic material. Alluvial fan sediments: sand and gravel, with diamicton; poorly sorted; usually 2–10 m thick; located at the toe of slopes where a stream IV - Moderate likelihood of landslide initiation issues from a confined channel and at the mouths of narrow valleys. Alluvial terrace sediments: sand, gravel, and minor silt; mostly well V - High likelihood of landslide initiation sorted and stratified; 2-10 m thick; forming terraces well above modern **Alluvial veneer:** sand and gravel; deposited by streams; less than 2 m Alluvial sediments, undifferentiated: floodplain, terrace, and fan 127°45'31"W 54°6'29"N 128°4'7"W 54°6'39"N Figure 1. Terrain stability map of the Nimbus Mountain-Clore River canyon area based on British Columbia's Forest Practice Code (British Columbia Ministry of Forests, 1999). sediments; variable thickness with thicker deposits (greater than 3 m) where exposed on erosional scarps; appears only as secondary unit in stratigraphic relationships within polygons. LACUSTRINE SEDIMENTS: fine sand, silt, and clay; well sorted, massive, or laminated; deposited in deeper water of temporary, fresh-water lakes; may include sporadic sand and gravel deposited in a nearshore environment. Lacustrine veneer: fine sand, silt, and clay; less than 2 m thick; appears only as secondary unit in complex polygons. Lacustrine blanket: fine sand, silt, and clay; greater than 2 m thick; appears only as secondary unit in stratigraphic relationships within FRASER GLACIATION (WISCONSINAN) PROGLACIAL AND GLACIAL ENVIRONMENT GLACIOFLUVIAL SEDIMENTS: sand and gravel with minor diamicton, well sorted to poorly sorted, and well stratified to poorly stratified; variable thickness; deposited by glacial meltwater at or in close proximity to stagnating or retreating glaciers; bedding may have been disrupted locally following the melting of supporting ice. Glaciofluvial terrace sediments: sand and gravel, stratified to massive; 1–10 m thick; forming terraced deposits along valley walls or associated with meltwater channels and perched well above modern alluvial Glaciofluvial outwash-fan sediments: poorly sorted sand and gravel; bedded; 1 m to more than 10 m thick; deposited at various positions in front of retreating glaciers; generally forms a fan-shaped surface sloping away from a meltwater source; appears only as secondary unit in Glaciofluvial veneer: sand and gravel; generally less than 2 m thick; sediment cover may be discontinuous in places and follows the Glaciofluvial blanket: sand and gravel, stratified to massive; usually more than 2 m thick; sediment cover is continuous, but the underlying morphology is often visible; commonly located adjacent to meltwater channels. Glaciofluvial sediments, undifferentiated: sand and gravel of unknown extent and thickness, usually occurring on an erosional slope (scarp) or underlying Holocene sediment. GLACIAL ENVIRONMENT TILL: diamicton consisting of poorly sorted pebbles, cobbles, and boulders in a sandy to clayey matrix; directly deposited by glaciers; may contain small inclusions of glaciofluvial sediments, especially in valley bottoms and near the mouths and banks of meltwater channels; includes till that has been reworked due to gravity on steep slopes. Hummocky till: hummocky to rolling till surface that may include discontinuous lenses of glaciofluvial gravel; greater than 2 m thick on average and may exceed 5 m thick; appears only as secondary unit in stratigraphic relationships within polygons. Ridged till, moraine: diamicton mainly consisting of loose gravel; occurs in ridged topography associated with recent to current alpine glaciers and as valley-floor lateral and terminal moraines; variable thickness, but may exceed more than 10 m thick along ridge crests. **Till veneer:** diamicton; less than 2 m thick on average; underlying bedrock morphology is discernible and where till cover is discontinuous, bedrock outcrops are abundant. Till blanket: diamicton; more than 2 m thick on average; continuous till cover with few bedrock outcrops; conforming to and locally obscuring topography of underlying units. Till, undifferentiated: till deposits of unknown extent and thickness; usually overlain by postglacial nonglacial sediments; till exposed on an erosional slope (scarp) commonly exceeds 3 m thick. WEATHERED BEDROCK: rock fragments of rubble to block size, with variable amounts of residual silt, sand, or clay, depending on the original bedrock type; derived from bedrock that is decomposed or disintegrated in situ by mechanical or chemical weathering. Weathered bedrock veneer: less than 2 m thick; discontinuous cover with abundant bedrock outcrops. **BEDROCK:** Mesozoic and Cenozoic igneous and metamorphic organic material that is less than 10 cm to 20 cm thick. Dominantly igneous bedrock: includes mainly hard, unaltered granitic, Bedrock, Undifferentiated: used for areas of apparant softer and highly altered and fractured bedrock, likely mainly consisting of clastic volcanic rocks. Complex units: two map-unit designators are used in cases where the surficial cover forms a complex area and the map units are too small to be mapped individually, yet constitute a significant areal extent of the total polygon (e.g. Tv.Tb designates an area of till veneer deposits with numerous outcrops of till blanket). In such instances a dot (.) is used to separate the map-unit designators. Stratigraphic relationship: a stratigraphic relationship is shown with two map-unit designators separated by a slash (/) (e.g. GFv/Tb indicates glaciofluvial veneer overlying till blanket). Geological boundary (confidence approximate) . . Limit of mapping Landslide track, sediment-transport direction ----- Meltwater channel • • • • Moraine ridge Recommended citation Maynard, D.E., Weiland, I.C., and Blais-Stevens, A., 2019. Surficial geology, Nimbus Mountain and Clore River canyon, Kitimat-Morice River corridor, British Columbia, parts of NTS 103-I/1, 93-L/4 and 5; Geological Survey of Canada, Canadian Geoscience Map 320, scale 1:25 000. https://doi.org/10.4095/308311 128°04'00" **CANADIAN GEOSCIENCE MAP 320** 

500 0 500 1000 1500 2000 m

**CANADIAN GEOSCIENCE MAP 320 SURFICIAL GEOLOGY** NIMBUS MOUNTAIN AND CLORE **RIVER CANYON** Kitimat-Morice River corridor, British Columbia parts of NTS 103-I/1, 93-L/4 and 5

POST-FRASER GLACIATION

GLACIER ICE OR SNOWPACK

Glacier or icecap: alpine glacier ice; variable thickness.