Holocene earth materials and landforms DESCRIPTIVE NOTES REFERENCES **Organic Deposits** INTRODUCTION Peat bogs: fibric to humic organic matter: massive to stratified accumulations Bednarski, J.M., 2003a. Betalamea Lake, Northwest Territories – Yukon Territory – British Columbia (NTS This Surficial Geology Map of NTS 94-O/5 (Canadian Geoscience Map 109) is the product of collaboration between the Geological Survey of generally greater than 2 m thick; confined to topographic depressions or level 95B/4); Geological Survey of Canada, Open File 4502, scale 1:50 000. Canada and the British Columbia Ministry of Energy, Mines and Natural Gas as part of the Geo-mapping for Energy and Minerals Program areas; underlain by poorly drained till, glaciolacustrine and other (GEM-Energy Yukon Basins Project. The accompanying geodatabase includes field observation points and field photos, landform features as unconsolidated sediments: formed by decomposition of plant material in Bednarski, J.M., 2003b. Surficial geology of Fort Liard, Northwest Territories - British Columbia. Geological lines, and sufficial geology unit polygons. The map and geodatabase are essential baseline geoscience information for a range of potentia wetland areas; bogs with sporadically discontinuous permafrost and end-users including resource explorationists, geotechnical engineers, land-use managers, terrestrial ecologists, archaeologists Survey of Canada, Open File 1760, scale 1:50 000 geoscientists and communities in northern British Columbia. By providing new insight into the distribution and origins of surficial earth thermokarst depressions potentially unstable if organic material is disturbed or Bednarski, J.M., 2003c. Surficial geology of Lake Bovie, Northwest Territories - British Columbia. Geological Survey of Canada, Open File 1761, scale 1:50 000. materials, CGM 109 will help to reduce the economic costs and risks associated with the sustainable development of energy and mineral resources in NTS 94-O/5. Environmental impact assessments for new access roads, work camps, well pads, pipeline and power transmission corridors, water storage and waste management systems and other infrastructure will benefit from the geoscience information presented Fens: fibric organic matter; massive to stratified; generally greater than 2 m Bednarski, J.M., 2003d. Surficial geology of Celibeta Lake, Northwest Territories - British Columbia. Geological Survey of Canada, Open File 1754, scale 1:50 000. here. By identifying areas prone to geological hazards (e.g., landslides, permafrost, flooding), CGM 109 will also help to protect natural resources, infrastructure and communities vulnerable to climate change in Canada's north. thick; confined to topographic depressions, level areas and meltwater channels; underlain by poorly drained till, glaciolacustrine and other unconsolidated sediments; formed by decomposition of plant material in APPROACH TO SURFICIAL GEOLOGY MAPPING Bednarski, J.M., 2005a. Surficial Geology of Etsine Creek, British Columbia, Geological Survey of Canada, Open wetland areas; fens are prone to flooding following drainage damming by Terrain mapping and field-based benchmarking studies have led to a better understanding of the regional distribution of surficial deposits, permafrost, landslides and other geomorphic processes in the NTS 94-O/5 map area (Huntley and Hickin, 2010; Huntley et al., 2011a-b Surficial earth materials and landforms were classified using a combination of stereo-pair aerial photographs (BCB97010, 15BCB97015, ednarski, J.M., 2005b. Surficial Geology of Gote Creek, British Columbia, Geological Survey of Canada, Open Undifferentiated peat bogs and fens: humic to fibric organic matter; massive 15BCB97029, 15BCB97075 and 15BCB97088 series), LANDSAT 7 satellite imagery (http://glovis.usgs.gov/ [URL 2011]) and Shuttle Radar Topography Mission digital elevation models (http://dds.cr.usgs.gov/srtm/ [URL 2011]). The base map was generated from CANVEC shape to stratified accumulations; generally greater than 2 m thick; confined to files (http://geogratis.cgdi.gc.ca/geogratis/ [URL 2011]). Surficial geology polygons and landform line symbols were digitized using Clement, C., Kowall, R. Huntley, D. and Dalziel, R., 2004. Ecosystem units of the Sahtaneh area; Slocan Forest tonographic depressions. level areas or channels; underlain by poorly drained commercially available computer software packages (Global Mapper, ArcMap and ArcGIS) and compared to published maps, reports and archived digital data (e.g., Stott and Taylor, 1968; Bednarski, 2003a-d; Clement et al., 2004; Bednarski, 2005a-b; Demchuk, 2010). The Products (Fort Nelson) Report, 39 pages and appendices. till, glaciolacustrine and other unconsolidated sediments; formed by decomposition of plant material in wetland areas; may contain sporadically Deblonde, C., Plouffe, A., Boisvert, E., Buller, G., Davenport, P., Everett, D., Huntley, D., Inglis, E., Kerr, D., Moore, A., Paradis, S.J., Parent, M., Smith, R., St-Onge, D., and Weatherston, A., 2012. Science Language eodatabase accompanying this map conforms to the Science Language for the Data Management component of the GEM Geological Map discontinuous permafrost and thermokarst depressions; potentially unstable if Flow process (cf. Huntley and Sidwell, 2010; Huntley et al., 2011a; Deblonde et al., 2012). disturbed or removed during development. for an Integrated Geological Survey of Canada Data Model for Surficial Maps Version 1.1 Results of Fieldwork was undertaken in 2009 and 2010 to ground truth surficial geology polygons interpreted from air photos and satellite imagery, and to gather characteristics that could not be determined through remote predictive mapping. Earth materials were defined on the basis of facies Geological Survey of Canada Surficial Legend Review Committee; Geological Survey of Canada, Open File nd landform associations, texture, sorting, colour, sedimentary structures, degree of consolidation, and stratigraphic contact relationships a Alluvial fan sediments: boulders, gravel, sand and silt; generally massive to Demchuk, T., 2010. Surficial geology of the Komie Creek area (NTS 094P/05). British Columbia Ministry of field stations and remote observations from helicopters. The distribution of glacial and non-glacial landforms is depicted on the surficial planar stratified; well to rapidly drained; greater than 2 m thick; fan morphology Energy, Mines and Petroleum Resources, Open File 2010-08; Geological Survey of Canada Open File 6568, geology map. Map units in the Legend include organic deposits, alluvial, colluvial, eolian, glaciolacustrine and glaciofluvial sediments, tills and with slopes up to 15°; may contain interbedded debris flows and buried scale 1:50 000. organic material; transported and deposited by modern rivers, streams and Huntley, D.H. and Hickin, A.S., 2010. Surficial deposits, landforms, glacial history and potential for granular INFERRED GEOLOGICAL HISTORY creeks; subject to periodic flooding; potential source of aggregate. aggregate and frac sand: Maxhamish Lake Map Area (NTS 94-O), British Columbia. Geological Survey of The distinctive landscape of NTS 94-O/5 is largely a product of underlying bedrock and geological structures, with ornamentation by the Late Alluvial terraced sediments: boulders, gravel, sand and silt; generally Wisconsinan Laurentide Ice Sheet. In the north and west, uplands are underlain by shale, siltstone and sandstone (Upper Cretaceous Kotaneelee Formation). In the southeast, conglomerate, sandstone and carbonaceous shale (Upper Cretaceous Dunvegan Formation) forms prominent bedrock escarpments along the Fort Nelson River and in the Tsoo Tablelands. Below this formation, undifferentiated clastic bedrock massive to planar stratified; well to rapidly drained; greater than 2 m thick; may Huntley, D., Hickin, A. and Chow, W., 2011a. Surficial geology, geomorphology, granular resource evaluation and contain interbedded debris flows and buried organic material; underlain by geohazard assessment for the Maxhamish Lake map area (NTS 94-O), northeastern British Columbia; (Lower Cretaceous Fort St. John Group) is exposed in river sections (Stott and Taylor, 1968). outwash, till or bedrock; transported and deposited by modern rivers, streams Geological Survey of Canada, Open File 6883, 20 pages. and creeks; subject to rare flooding; potential source of aggregate; land use Topography and drainage patterns were greatly modified during the phase of maximum ice cover (>18 ¹⁴C ka BP or >21.4 calendar ka BP). Huntley, D.H., Hickin, A.S. and Ferri, F., 2011b. Provisional surficial geology, glacial history and paleogeographic reconstructions of the Toad River (NTS 94-N) and Maxhamish Lake map areas (NTS 94-O), British Columbia. activities may adversely affect stream courses and conditions, and impact fish consolidated sediment thicknesses in excess of 2-5 m are observed in valleys and it is suspected that similar drift thicknesses blanket and wildlife resources. bedrock (unit R) across the map area. Silt- and clay-rich Laurentide tills have low clast contents (<20%) of proximally derived Cretaceous eoscience Reports 2011, BC Ministry of Energy, pages 37-55. siliciclastic sedimentary rocks and distal igneous and metamorphic clasts from the Canadian Shield, hundreds of kilometres to the northeast. Alluvial floodplain sediments: gravel, sand and silt; massive, trough Drumlin ridges up to several hundred metres in length suggest clay-rich tills (unit Ts) were deposited beneath active, rapidly flowing warm-Huntley, D.H. and Sidwell, C.F., 2010. Application of the GEM surficial geology data model to resource evaluation crossbedded, rippled-bedded, planar stratified; well to rapidly drained; greater based glacial ice (Huntley and Hickin, 2010; Huntley et al., 2011b). Lake basins were excavated by erosion and ice-thrusting as Laurentide ice and geohazard assessment for the Maxhamish Lake map area (NTS 94-O), British Columbia. Geological and subglacial meltwater scoured and deformed older glacial deposits and poorly indurated Cretaceous bedrock. Two phases of ice flow are than 2 m thick; underlain by till or bedrock; transported and deposited by Survey of Canada, Open File 6553, 22 pages. recognized in the map area. An early (glacial maximum) southwest ice flow preserved in the Tsoo Tablelands, and locally on the Liard Plateau modern rivers, streams and creeks; subject to seasonal flooding; land use is cross-cut by later westward flow. These ice flow phases indicate a re-organization of drainage patterns as the Laurentide Ice Sheet margin activities may adversely affect stream courses and conditions, and impact fish Stott, D.F. and Taylor, G.C., 1968. Geology of Maxhamish Lake. Geological Survey of Canada, Map 2-1968, retreated eastward from the map area. and wildlife resources. Deglaciation began sometime after 18 ¹⁴C ka BP (or >21.4 calendar ka BP) and ended before 10 ¹⁴C ka BP (ca. 12 calendar ka BP), with the Colluvial deposits retreat of the Laurentide Ice Sheet, stagnant ice masses, glaciofluvial outwash and landslide debris blocked and reordered regional drainage The mapped distribution of moraine ridges (unit Tm) implies that ice margins receded northeast from the Tsoo Tablelands and east across the Colluvial veneer: clast-supported diamictons and rubble; massive to stratified, Liard Plateau (Huntley and Hickin, 2010). Minor moraine ridges drape drumlins in cross-cutting patterns and are interpreted as crevasse poorly-sorted; well to rapidly drained; deposits less than 2 m thick; landslide fillings and squeeze moraines deposited shortly after drumlinization ended, or as ice retreated from the map area (Huntley et al., 2011b). neadscarps range from 300 m to 10.5 km; formed by the weathering and Hummocky till (unit Th) is associated with short segments of subareal-subglacial meltwater channels and eskers and indicates that bodies of down-slope movement of earth materials by gravitational processes; bedrock stagnant glacier ice remained in lowland areas west of the Maxhamish Escarpment (Huntley et al., 2011a; Huntley et al., 2011b), As ice and unconsolidated debris on slopes above 10-15° with greater than 5 m relief retreated from the map area, a proglacial lake system formed on the Liard Plateau and tributary valleys in the Tsoo Tablelands. Proglacial lakes were linked by spillways that drained meltwater northward into the Mackenzie River basin. In the map area, glaciolacustrine deposits (unit prone to mass-wasting; rock falls, topples, rock slides and debris flows occur GLb), glaciofluvial terraces (unit GFt), and meltwater channels incised into till and bedrock indicate that glacial lake levels fell stepwise through where shale, sandstone and carbonate strata is exposed close to the surface; deglaciation, with stable elevations at approximately 620 m, 540 m, 420 m, 380 m and <300 m. The absence of pronounced shorelines retrogressive rotational debris slides, debris flows and slumps occur in suggests proglacial lakes were short-lived. In some areas, fine-grained glacial earth materials have been re-worked by eolian activity and glaciolacustrine sediments and outwash containing sporadically discontinuous discontinuous loess covers glacial lake and till deposits. permafrost; where ground ice is found slope failure can occur on surfaces less Post-glaciation (10 ¹⁴C ka BP, or ca. 12 calendar ka BP to present), changes in regional base-level led to episodes of channel incision and than 5°; slope instability could present major problems for construction in aggradation, and resulted in the formation of erosional alluvial terraces along most stream and river valleys. In the early Holocene, pulses of some areas. fluvial terrace formation followed initial valley incision by the Liard and other major rivers. Most streams and rivers have alluvial fans (unit Af) and terraces (unit At) <5 m above active floodplains (unit Ap) consisting of gravel overlain by silt and sand. Poorly drained clay-rich till on the Colluvial blanket: clast-supported diamictons and rubble; massive to plateaux and glaciolacustrine sediments in lowland areas are covered by extensive postglacial peat deposits (unit Owb), fens (unit Owb) and stratified, poorly-sorted; well to rapidly drained; deposits greater than 2 m undifferentiated wetlands (unit O). Discontinuous permafrost is sporadically encountered in glaciolacustrine and some peat deposits. Charcoal, observed in dug pits on alluvial terraces, suggest forest fires may have contributed to periods of landslide activity on slopes and local thick; landslide headscarps range from 300 m to 10.5 km; formed by the weathering and down-slope movement of earth materials by gravitational fluvial aggradation. Landslides and colluviated deposits (units Cv, Cb) are common where bedrock outcrops form escarpments, and where processes; bedrock and unconsolidated debris on slopes above 10-15° with shale or fine-grained glacial deposits are exposed along steep cutbanks. Stream networks and wetlands draining plateau watersheds are disrupted by beaver activity and, to a lesser extent, by roads and infrastructure where they cross streams, rivers and organic deposits (Huntley greater than 5 m relief prone to mass-wasting; rock falls, topples, rock slides and Hickin, 2010; Huntley and Hickin, 2011a-b). and debris flows occur where shale, sandstone and carbonate strata is exposed close to the surface; retrogressive rotational debris slides, debris ACKNOWLEDGMENTS flows and slumps occur in glaciolacustrine sediments and outwash containing Canadian Geoscience Map 109 is an output of the Geo-Mapping for Energy and Minerals Yukon Basins Project managed by Carl Ozyer and sporadically discontinuous permafrost; where ground ice is found slope failure Larry Lane (GSC-Calgary). The assistance of Robert Cocking, Sean Eagles, Vic Dohar, Mike Sigouin, Scott Tweedy and Martin Legault can occur on surfaces less than 5°; slope instability could present major (NRCAN Scientific Publishing Services) was greatly appreciated throughout the map-making process. A critical review of CGM 109 was provided by Dan Kerr (GSC-Ottawa). problems for construction in some areas. Late Pleistocene earth materials and landforms Canadian Geoscience Map 109 depicts the surficial La Carte géoscientifique du Canada 109 illustre la Glaciolacustrine deposits geology and landforms over some 790 km² covered by géologie des matériaux superficiels et les formes de Glaciolacustrine blanket: silt and clay with subordinate sand, gravel and the Capot-Blanc Creek map sheet (NTS 94-O/05) in terrain d'un territoire d'environ 790 km² couvert par le diamicton; massive or rhythmically interbedded; slump structures and northeastern British Columbia. The map area lies at the feuillet cartographique de Capot-Blanc Creek (SNRC dropstones locally present; poor to moderately drained; generally greater than northern limit of the Tsoo Tablelands (Alberta Plateau) 94-O/05), dans le nord-est de la Colombie-Britannique. 2 m thick; kettle lakes and irregular topography underlain by bedrock, tills and and western limit of the Liard Plateau. Respectively, La région cartographique se situe à la limite nord des outwash: transported by and deposited from sediment-laden meltwater. these uplands are incised by the Fort Nelson River and hauts plateaux de Tsoo (plateau de l'Alberta) et à la subaqueous gravity flows and melting of ice in proglacial lakes; where north-draining tributaries; and the Capot-Blank Creek. limite occidentale du plateau de Liard. Ces hautes sporadically discontinuous permafrost is, or was present, glaciolacustrine draining west into the Liard River. Bedrock is mantled terres sont entaillées dans le premier cas par la rivière sediments may be subject to thermokarst processes; slopes less than 5° are by unconsolidated earth materials dating to the Late de Fort Nelson et ses affluents à écoulement nord et, potentially unstable and prone to landslides and debris flows. Pleistocene (Late Wisconsinan Glaciation, > 25 ka to dans le second, par le ruisseau Capot-Blank qui coule vers l'ouest pour se jeter dans la rivière Liard. Le socle ca. 10 ka before present, BP) and non-glacial Holocene Glaciofluvial deposits (ca. 10 ka BP to present). Deposits of till, green on the rocheux est couvert de matériaux terrestres non Outwash terraces: boulders, cobbles, pebble-gravel, sand, silt and map, are generally suitable for placement of consolidés remontant au Pléistocène supérieur matrix-supported diamicton; generally massive to stratified, some slump infrastructure. Glaciofluvial and eolian deposits with (Glaciation du Wisconsinien supérieur, de > 25 ka à structures; moderately to well-drained; greater than 2 m thick; terrace scarps env. 10 ka) ainsi que de matériaux non glaciaires de mineral, aggregate and groundwater potential are range from 100 m to 8 km in length; in contact with, and overlying other till l'Holocène (d'env. 10 ka jusqu'à nos jours). Les dépôts coloured orange and buff. Slopes disturbed by units, outwash and glaciolacustrine sediments; deposited by meltwater landslides, debris flows and rock falls appear brown and de till, de couleur verte sur la carte, sont généralemen confined to proglacial channels and spillways; potential source of groundwater pink. Glaciolacustrine and organic deposits with propices à l'établissement de l'infrastructure. Les and granular aggregate when material is gravel rich. sporadically discontinuous permafrost are coloured dépôts fluvioglaciaires et éoliens, qui recèlent un purple and grey. Alluvial deposits prone to flooding, potentiel en minéraux, en agrégats et en eau erosion and sedimentation appear yellow on the map. souterraine, sont figurés par les couleurs orange et Moraine ridges: sand, silt and clay-rich diamictons; massive, chamois. Les versants dérangés par des glissements matrix-supported; clast contents less than 20% and contain sub-rounded des coulés de débris et des chutes de blocs sont granitic erratic boulders with sources on the Canadian Shield; moderately to représentés en brun et en rose. Les dépôts well-drained; greater than 2 m thick; minor moraines less than 1 km long and 5 glaciolacustres et organiques, qui renferment m high; major moraines up to 12.5 km in length and 10 m high; ridges drape sporadiquement du pergélisol discontinu, sont bedrock and older glacial deposits; minor moraines include crevasse-fill ridges représentés en violet et en gris. Les dépôts alluviaux and small recessional push moraines; major ridges features are large sujets aux inondations, à l'érosion et à la sédimentation recessional end moraines and ice-thrust ridges; generally suitable for apparaissent en jaune sur la carte. infrastructure placement. Streamlined till: silt and clay-rich diamictons; massive, matrix-supported and compact; clast contents less than 20% and contain sub-rounded granitic CGM 122 | CGM 125 erratic boulders with sources on the Canadian Shield; moderately well-drained; greater than 2 m thick mantling bedrock and older glacial deposits; drumlins and fluted till ridges typically under 1 km long but can exceed 9 km in length; generally less than 50 m wide and 20 m high; formed beneath the Laurentide Ice Sheet directly through lodgement, basal meltout, CGM 109 CGM 128 glacigenic deformation of sediment beneath rapidly-flowing warm-based ice, generally suitable for infrastructure placement. Till veneer: sand, silt and clay-rich diamictons; massive, matrix-supported and compact; clast contents less than 20% and contain sub-rounded granitic erratic boulders with sources on the Canadian Shield; moderately to CGM 108 CGM 107 well-drained; less than 2 m thick draping bedrock and older glacial deposits; transported and deposited by the Laurentide Ice Sheet directly through lodgement, basal meltout, glacigenic deformation beneath active, warm-based ice and in situ melting from stagnant cold-based ice; generally suitable for National Topographic System reference and index to adjoining infrastructure placement. published Geological Survey of Canada maps Pre-Quaternary earth materials and landforms Cover illustration Undifferentiated bedrock: conglomerate, sandstone, siltstone, shale and Catalogue No. M183-1/109-2012E-PDF Ribbed fen, moraines and drumlins, north of the For limestone; exposed in escarpments between 300 m and 80 km in length; ISBN 978-1-100-21445-0 Nelson River valley and Tsoo Tablelands, northeast slopes above 10-15° with greater than 5 m relief prone to rock falls, topples doi:10.4095/292001 British Columbia, view south. rock slides and debris flows; Paleozoic unconformably overlain by Mesozoic Photograph by D.H. Huntley. 2013-082 sedimentary rocks; limestone and clastic sedimentary rocks are a potential © Her Majesty the Queen in Right of Canada 2013 source of crushed granular aggregate. ---- Geological boundary (Confidence: approximate) Bedrock scarp Natural Resources Ressources naturelles du Canada ● ● ● ● ● Major moraine ridge (unspecified) Other moraine ridge (unspecified) → Drumlin ridge **CANADIAN GEOSCIENCE MAP 109** Major meltwater channel scarp **SURFICIAL GEOLOGY** Minor meltwater channel central axis (unspecified; sense: known) **CAPOT-BLANC CREEK** Terrace scarp (environment: glaciofluvial) British Columbia Terrace scarp (environment: fluvial) 1:50 000 Terrace scarp (environment: glaciolacustrine) Station location (ground observation) Recommended citation Huntley, D.H., Hickin, A.S., Chow, W., and Mirmohammadi, M., 2013. Surficial geology, Capot-Blanc Creek, British Columbia; Geological Survey of Canada, Canadian Geoscience Map 109 (preliminary), scale 1:50 000. doi:10.4095/292001 **Preliminary Preliminary CANADIAN GEOSCIENCE MAP 109 Preliminary Preliminary Preliminary SURFICIAL GEOLOGY** Canadian Authors: D.H. Huntley, A.S. Hickin, W. Chow, and Geomatics by D.H. Huntley, W. Chow, and Map projection Universal Transverse Mercator, The Geological Survey of Canada welcomes M. Mirmohammadi zone 10. North American Datum 1983 M. Mirmohammadi corrections or additional information from users. **CAPOT-BLANC CREEK Geoscience Maps** Base map at the scale of 1:50 000 from Natural Geology by D.H. Huntley and A.S. Hickin (2009–2010) Cartography by W. Chow This publication is available for free download through Resources Canada, with modifications. GEOSCAN (http://geoscan.ess.nrcan.gc.ca/). **British Columbia** Geological compilation by D.H. Huntley (2009–2011) Initiative of the Geological Survey of Canada, Elevations in feet above mean sea level conducted under the auspices of the Yukon Basin 1:50 000 reliminary publications li Project as part of Natural Resources Canada's Geo-Magnetic declination 2013, 20°33'E this series have not been mapping for Energy and Minerals (GEM) program decreasing 21' annually. **CANADIAN GEOSCIENCE MAP 109** scientifically edited. **SURFICIAL GEOLOGY**

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CANADIAN GEOSCIENCE MAP 109

CAPOT-BLANC CREEK

British Columbia