Holocene earth materials and landforms DESCRIPTIVE NOTES Organic Deposits ———— Geological boundary (Confidence: approximate) Peat bogs: fibric to humic organic matter; massive to stratified accumulations; INTRODUCTION generally greater than 2 m thick; confined to topographic depressions or level This Surficial Geology Map of NTS 94-O/15 (Canadian Geoscience Map 119) is the product of collaboration between the Geological Survey of Bedrock scarp 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 • • • • • • • • Major moraine ridge (end, interlobate, or unspecified) lines, and surficial geology unit polygons. The map and geodatabase are essential baseline geoscience information for a range of potential wetland areas; bogs with sporadically discontinuous permafrost and end-users including resource explorationists, geotechnical engineers, land-use managers, terrestrial ecologists, archaeologists, thermokarst depressions potentially unstable if organic material is disturbed or geoscientists and communities in northern British Columbia. By providing new insight into the distribution and origins of surficial earth materials, CGM 119 will help to reduce the economic costs and risks associated with the sustainable development of energy and mineral Other moraine ridge (DeGeer, minor lateral, recessional, rogen, washboard, other transverse or unspecified) resources in NTS 94-O/15. Environmental impact assessments for new access roads, work camps, well pads, pipeline and power Fens: fibric organic matter; massive to stratified; generally greater than 2 m transmission line corridors, water storage and waste management systems and other infrastructure will benefit from the geoscience <><><>> Esker ridge (sense: unknown or unspecified) nformation presented here. By identifying areas prone to geological hazards (e.g., landslides, permafrost, flooding), CGM 119 will also help to thick; confined to topographic depressions, level areas and meltwater protect natural resources, infrastructure and communities vulnerable to climate change in Canada's north. channels; underlain by poorly drained till, glaciolacustrine and other unconsolidated sediments; formed by decomposition of plant material in APPROACHTO SURFICIAL GEOLOGY MAPPING 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/15 map area (Huntley and Hickin, 2010; Huntley et al., 2011a-b). ----- Landslide escarpment (Status: inactive or unspecified) Surficial earth materials and landforms were interpreted using a combination of stereo-pair air photos (BCB97010, 15BCB97015, 15BCB97029, 15BCB97075 and 15BCB97088 series), LANDSAT 7 satellite imagery (http://glovis.usgs.gov/ [URL 2011]) and Shuttle Radar Major meltwater channel scarp Undifferentiated peat bogs and fens: humic to fibric organic matter; massive to stratified accumulations; generally greater than 2 m thick; confined to Topography Mission digital elevation models (http://dds.cr.usgs.gov/srtm/ [URL 2011]). The base map was generated from CANVEC shape files (http://geogratis.cgdi.gc.ca/geogratis/ [URL 2011]). Surficial geology polygons and landform line symbols were digitized using commercially available computer software packages (Global Mapper, ArcMap and ArcGIS) and compared to published maps, reports and topographic depressions, level areas or channels; underlain by poorly drained unspecified; sense: known) till, glaciolacustrine and other unconsolidated sediments; formed by archived digital data (e.g., Stott and Taylor, 1968; Bednarski, 2003a-d; Clement et al., 2004; Bednarski, 2005a-b; Trommelen and Levson, 2008; Demchuk, 2010). The geodatabase accompanying this map conforms to the Science Language for the Data Management component decomposition of plant material in wetland areas; may contain sporadically Terrace scarp (environment: glaciofluvial) discontinuous permafrost and thermokarst depressions; potentially unstable if of the GEM Geological Map Flow process (cf. Huntley and Sidwell, 2010; Huntley et al., 2011a; Deblonde et al., 2012). disturbed or removed during development. Terrace scarp (environment: fluvial) Fieldwork was undertaken in 2009 and 2010 to ground truth surficial geology polygons interpreted from air photos and satellite imagery, and to the properties of the propertgather characteristics that could not be determined through remote predictive mapping. Earth materials were defined on the basis of facies and landform associations, texture, sorting, colour, sedimentary structures, degree of consolidation, and stratigraphic contact relationships at Station location (ground observation or stratigraphic section) Alluvial fan sediments: boulders, gravel, sand and silt; generally massive to 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 geology map. Map units in the Legend are presented chronostratigraphically and include organic deposits, alluvial, colluvial, eolian, with slopes up to 15o; may contain interbedded debris flows and buried glaciolacustrine and glaciofluvial sediments, tills and areas of bedrock. organic material; transported and deposited by modern rivers, streams and ACKNOWLEDGMENTS creeks; subject to periodic flooding; potential source of aggregate. INFERRED GEOLOGICAL HISTORY $The \ distinctive \ landscape \ of \ NTS \ 94-O/15 \ is \ largely \ a \ product \ of \ underlying \ bedrock \ and \ geological \ structures, \ with \ ornamentation \ by \ the \ Late$ Alluvial terraced sediments: boulders, gravel, sand and silt; generally Canadian Geoscience Map 119 is an output of the Geo-Mapping for Energy and Minerals Yukon Basins Project Wisconsinan Laurentide Ice Sheet. In the west, quartz-rich sandstone and shale (Lower Carboniferous Mattson Formation), and limestone managed by Carl Ozyer and Larry Lane (GSC-Calgary). The assistance of Robert Cocking, Sean Eagles, Vic Dohar, Mike Sigouin, Scott Tweedy and Martin Legault (NRCAN Scientific Publishing Services) was greatly massive to planar stratified; well to rapidly drained; greater than 2 m thick; may and shale (Flett Formation) are exposed along the crest and flanks of the Maxhamish Escarpment. This inlier is surrounded by undifferentiated contain interbedded debris flows and buried organic material; underlain by clastic bedrock (Lower Cretaceous Fort St. John Group) and conglomerate, sandstone and carbonaceous shale (Upper Cretaceous appreciated throughout the map-making process. A critical review of CGM 119 was provided by Ron DiLabio Dunvegan Formation). Lying to the east of the Maxhamish Escarpment, much of the map area encompasses the northwest limit of the Etsho outwash, till or bedrock; transported and deposited by modern rivers, streams Plateau and a portion of the Petitot River watershed and is underlain by undifferentiated sedimentary rocks of the Lower Cretaceous Fort St. and creeks; subject to rare flooding; potential source of aggregate; land use John Group (Stott and Taylor, 1968). activities may adversely affect stream courses and conditions, and impact fish and wildlife resources. Topography and drainage patterns were greatly modified during the phase of maximum ice cover (>18 st C ka BP or >21.4 calendar ka BP). Inconsolidated sediment thicknesses in excess of 2 to 40 m are observed in valleys and it is suspected that similar drift thicknesses blanke Alluvial floodplain sediments: gravel, sand and silt; massive, trough bedrock (unit R) across the map area. Glacial advance phase glaciofluvial and glaciolacustrine deposits are locally exposed beneath glacia cross-bedded, rippled-bedded, planar stratified; well to rapidly drained; greater maximum till in sections along Petitot River. Emile Creek and recorded in seismic shothole records (Smith and Lesk-Winfield, 2009), Silt- and clay-rich Laurentide tills have low clast contents (<20%) of proximally derived Cretaceous siliciclastic sedimentary rocks and distal igneous than 2 m thick; underlain by till or bedrock; transported and deposited by and metamorphic clasts from the Canadian Shield, hundreds of kilometres to the northeast. Drumlin ridges up to several hundred metres in modern rivers, streams and creeks; subject to seasonal flooding; land use length suggest clay-rich tills (unit Ts) were deposited beneath active, rapidly flowing warm-based glacial ice (Huntley and Hickin, 2010; activities may adversely affect stream courses and conditions, and impact fish Huntley et al., 2011b). Streamlined till (unit Ts) is most pronounced south of the Petitot River and east of the Maxhamish Escarpment where ic flowed up-slope, and thick accumulations of till were deposited over soft bedrock and unconsolidated advance-phase sediments. Streamlined landforms and glacially striated bedrock suggest ice flow rotated from southwest to west across the map area, and was locally deflected by the Colluvial deposits Maxhamish Escarpment. Numerous small basins were excavated by erosion and ice-thrusting as Laurentide ice and subglacial meltwater Colluvial veneer: clast-supported diamictons and rubble; massive to stratified, scoured and deformed older glacial deposits and bedrock. poorly-sorted; well to rapidly drained; deposits less than 2 m thick; landslide Deglaciation began sometime after 18 ⁴C ka BP (or >21.4 calendar ka BP) and ended before 10 ¹⁴C ka BP (ca. 12 calendar ka BP), with the headscarps range from 300 m to 10.5 km; formed by the weathering and retreating active Laurentide Ice Sheet, stagnant ice masses in lowlands, glaciofluvial outwash and landslide debris blocking and reordering down-slope movement of earth materials by gravitational processes; bedrock regional drainage. The mapped distribution of major moraine ridges (unit Tm) implies that ice margins receded to the east across the map and unconsolidated debris on slopes above 10-15° with greater than 5 m relief sheet (Huntley and Hickin, 2010). Some large end moraines are deformed and streamlined suggesting that receding lobes remained active during`retreat´and occasionally´rapidly advanced. Minor moraine ridges drape drumlins in cross-cutting patterns and are interpreted as prone to mass-wasting; rock falls, topples, rock slides and debris flows occur crevasse fillings and squeeze moraines deposited shortly after drumlinization ended, or as ice retreated from the map area (Huntley et al., where shale, sandstone and carbonate strata is exposed close to the surface; 2011b). Hummocky till (unit Th) found with short segments of subareal-subglacial meltwater channels and eskers indicate that bodies of retrogressive rotational debris slides, debris flows and slumps occur in stagnant glacier ice remained in lowland areas west of the Maxhamish Escarpment. Eskers (unit GFr) are composed of hummocky till and glaciolacustrine sediments and outwash containing sporadically discontinuous placiofluvial grayelly sand, and likely exploited pre-existing crevasse patterns beneath the retreating ice sheet or stagnant ice bodies (Huntley permafrost; where ground ice is found slope failure can occur on surfaces less et al., 2011a, Huntléy et al., 2011b). As ice retreated from the map area, a proglacial lake system formed in the Petitot River valley. Proglacial than 5°; slope instability could present major problems for construction in lakes were linked by spillways that drained meltwater northward into the Liard River and Mackenzie River basins. In the map area, glaciolacustrine deposits (unit GLb), glaciofluvial terraces (unit GFt), and meltwater channels incised into till and bedrock indicate that glacial lake levels fell stepwise through deglaciation, with stable elevations at approximately 420 m, 380 m and <300 m. Most fine-grained glacial **Colluvial blanket**: clast-supported diamictons and rubble: massive to earth materials have been re-worked by eolian activity, and discontinuous loess covers glacial lake and till deposits in some places. stratified, poorly-sorted; well to rapidly drained; deposits greater than 2 m Post-glaciation (10 stC ka BP, or ca. 12 calendar ka BP to present), changes in regional base-level led to episodes of channel incision and thick; landslide headscarps range from 300 m to 10.5 km; formed by the aggradation, resulting in the formation of erosional alluvial terraces along most stream and river valleys. In the early Holocene, pulses of fluvial weathering and down-slope movement of earth materials by gravitational errace building followed initial valley incision by the Liard and other major rivers. Most streams and rivers have alluvial fans (unit Af) and processes; bedrock and unconsolidated debris on slopes above 10-15° with terraces (unit At) <5 m above active floodplains (unit Ap) consisting of gravel overlain by silt and sand. Poorly drained clav-rich till on the greater than 5 m relief prone to mass-wasting; rock falls, topples, rock slides plateaux and glaciolacustrine sediments in lowland areas are covered by extensive postglacial peat deposits (unit Owb), fens (unit Owf) and undifferentiated wetlands (unit O). Discontinuous permafrost is sporadically encountered in glaciolacustrine and some peat deposits. and debris flows occur where shale, sandstone and carbonate strata is Charcoal, observed in dug pits on alluvial terraces, suggest forest fires may have contributed to periods of landslide activity on slopes and local exposed close to the surface; retrogressive rotational debris slides, debris fluvial aggradation. Landslides and colluviated deposits (units Cv, Cb) are common where bedrock outcrops form escarpments, and where flows and slumps occur in glaciolacustrine sediments and outwash containing shale or fine-grained glacial deposits are exposed along steep cutbanks. Stream networks and wetlands draining plateau watersheds are sporadically discontinuous permafrost; where ground ice is found slope failure disrupted by beaver activity and, to a lesser extent, by roads and infrastructure where they cross streams, rivers and organic deposits (Huntley can occur on surfaces less than 5°; slope instability could present major and Hickin, 2010; Huntley and Hickin, 2011a-b). problems for construction in some areas. Late Pleistocene earth materials and landforms La Carte géoscientifique du Canada 119 illustre la Canadian Geoscience Map 119 depicts the surficial Glaciolacustrine deposits géologie des matériaux superficiels et les formes de geology over some 790 km² covered by the Emile terrain d'un territoire d'environ 790 km² couvert par le Creek map sheet (NTS 94-O/15) in northeastern British Glaciolacustrine blanket: silt and clay with subordinate sand, gravel and feuillet cartographique d'Emile Creek (SNRC 94-O/15). diamicton; massive or rhythmically interbedded; slump structures and Columbia. The Maxhamish Escarpment lies along the dans le nord-est de la Colombie-Britannique ropstones locally present; poor to moderately drained; generally greater than west margin of the map sheet. Much of the map area L'escarpement de Maxhamish s'étire le long de la limite 2 m thick; kettle lakes and irregular topography underlain by bedrock, tills and encompasses the northwest limit of the Etsho Plateau ouest de la région cartographique. La majeure partie de outwash; transported by and deposited from sediment-laden meltwater, and a portion of the Petitot River watershed. Much of la région cartographique est occupée par la bordure subaqueous gravity flows and melting of ice in proglacial lakes; where the map area is drained by Emile Creek and its nord-ouest du plateau d'Etsho Plateau et une partie du sporadically discontinuous permafrost is, or was present, glaciolacustrine tributaries which flow north into the Petitot River. bassin-versant de la rivière Petitot. La majeur partie de sediments may be subject to thermokarst processes; slopes less than 5° are Bedrock is mantled by unconsolidated earth materials la région cartographique est drainée par le ruisseau dating to the Late Pleistocene (Late Wisconsinan potentially unstable and prone to landslides and debris flows. Emile et ses affluents qui coulent vers le nord pour se Glaciation, > 25 ka to ca. 10 ka) and non-glacial Glaciofluvial deposits jeter dans la rivière Petitot. Le socle rocheux est couvert Holocene (ca. 10 ka to present). Deposits of till, green de matériaux terrestres non consolidés remontant au Kames and hummocky outwash: boulders, cobbles, pebble-gravel, sand, silt on the map, are generally suitable for placement of Pléistocène supérieur (Glaciation du Wisconsinien and diamicton; generally massive to stratified, some slump structures; infrastructure. Glaciofluvial deposits with mineral, supérieur, de > 25 ka à env. 10 ka) ainsi que de aggregate, and groundwater potential are coloured moderately to well-drained; greater than 2 m thick; irregular hummocks and matériaux non glaciaires de l'Holocène (d'env. 10 ka kettled topography; in contact with, and overlying till units, outwash and orange. Slopes disturbed by landslides, debris flows. jusqu'à nos jours). Les dépôts de till, de couleur verte glaciolacustrine sediments; deposited by rivers and streams flowing from, or in and rock falls appear brown and pink. Glaciolacustrine and organic deposits with sporadically discontinuou l'établissement de l'infrastructure. Les dépôts permafrost are coloured purple and grey. Alluvial aggregate when material is gravel rich. fluvioglaciaires, qui recèlent un potentiel en minéraux, deposits prone to flooding, erosion, and sedimentation Esker ridges: boulders, cobbles, pebble-gravel, sand, silt and en agrégats et en eau souterraine, sont figurés par la appear yellow on the map. matrix-supported diamicton; generally massive to stratified, some slump couleur orange. Les versants dérangés par des structures: moderately to well-drained; greater than 2 m thick; range from 100 glissements de terrain, des coulés de débris et des m to 8.8 km in length; in contact with, and overlying till units, outwash and chutes de blocs sont représentés en brun et en rose. Les dépôts glaciolacustres et organiques, qui glaciolacustrine sediments; deposited by subglacial meltwater in contact with renferment sporadiquement du pergélisol discontinu, glacial ice; potential source of groundwater and granular aggregate when material is gravel rich. sont représentés en violet et en gris. Les dépôts alluviaux suiets aux inondations, à l'érosion et à la Outwash terraces: boulders, cobbles, pebble-gravel, sand, silt and sédimentation apparaissent en jaune sur la carte. matrix-supported diamicton; generally massive to stratified, some slump structures; moderately to well-drained; greater than 2 m thick; terrace scarps range from 100 m to 8 km in length; in contact with, and overlying other till units, outwash and glaciolacustrine sediments; deposited by meltwater REFERENCES confined to proglacial channels and spillways; potential source of groundwater and granular aggregate when material is gravel rich. Bednarski, J.M., 2003a. Betalamea Lake, Northwest Territories - Yukon Territory - British Columbia (NTS 95B/4); Geological Survey of Canada, Open File 4502, scale 1:50 000. Hummocky till: sand and silt-rich diamictons; massive to stratified, matrix-Bednarski, J.M., 2003b. Surficial geology of Fort Liard, Northwest Territories - British Columbia. Geological and clast-supported; clast contents less than 20% and contain sub-rounded Survey of Canada, Open File 1760, scale 1:50 000. granitic erratic boulders with sources on the Canadian Shield; moderately to Bednarski, J.M., 2003c. Surficial geology of Lake Bovie, Northwest Territories - British Columbia. Geological Survey of Canada, Open File 1761, scale 1:50 000. vell-drained; greater than 2 m thick; drapes till and other glacial deposits; deposited by in situ melting from stagnant cold-based ice and modified by meltwater; evidence for ice collapse includes slump structures, kettle lakes Bednarski, J.M., 2003d. Surficial geology of Celibeta Lake, Northwest Territories - British Columbia. Geological and irregular topography; potential source of aggregate when material is gravel rich; generally suitable for infrastructure placement. CGM 125 | CGM 126 | CGM 123 Bednarski, J.M., 2005a. Surficial Geology of Etsine Creek, British Columbia, Geological Survey of Canada, Open Moraine ridges: sand, silt and clay-rich diamictons; massive, matrix-supported; clast contents less than 20% and contain sub-rounded Bednarski, J.M., 2005b. Surficial Geology of Gote Creek, British Columbia, Geological Survey of Canada, Open granitic erratic boulders with sources on the Canadian Shield; moderately to File 4846, scale 1:50 000. well-drained; greater than 2 m thick; minor moraines less than 1 km long and 5 National Topographic System reference and index to adjoining m high; major moraines up to 12.5 km in length and 10 m high; ridges drape published Geological Survey of Canada maps Clement, C., Kowall, R. Huntley, D. and Dalziel, R., 2004. Ecosystem units of the Sahtaneh area; Slocan Forest bedrock and older glacial deposits; minor moraines include crevasse-fill ridges Products (Fort Nelson) Report, 39 pages and appendices. and small recessional push moraines; major ridges features are large 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 recessional end moraines and ice-thrust ridges; generally suitable for Catalogue No. M183-1/119-2013E-PDF infrastructure placement. ISBN 978-1-100-21790-1 for an Integrated Geological Survey of Canada Data Model for Surficial Maps Version 1.1 Results of Drumlin ridges formed beneath a southwest flowing doi:10.4095/292396 ice sheet and a sinuous esker near Emile Creek in Streamlined till: silt and clay-rich diamictons; massive, matrix-supported and Geological Survey of Canada Surficial Legend Review Committee; Geological Survey of Canada Open File compact; clast contents less than 20% and contain sub-rounded granitic northeast British Columbia, view northeast, © Her Majesty the Queen in Right of Canada 2013 erratic boulders with sources on the Canadian Shield; moderately Photograph by D.H. Huntley. 2013-097 Demchuk, T., 2010. Surficial geology of the Komie Creek area (NTS 094P/05). British Columbia Ministry of well-drained; greater than 2 m thick mantling bedrock and older glacial Energy, Mines and Petroleum Resources, Open File 2010-08; Geological Survey of Canada Open File 6568, 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 Huntley, D.H. and Hickin, A.S., 2010. Surficial deposits, landforms, glacial history and potential for granular beneath the Laurentide Ice Sheet directly through lodgement, basal meltout, glacigenic deformation of sediment beneath rapidly-flowing warm-based ice; aggregate and frac sand: Maxhamish Lake Map Area (NTS 94-O), British Columbia. Geological Survey of Natural Resources Ressources naturelles Canada generally suitable for infrastructure placement. du Canada Huntley, D., Hickin, A. and Chow, W., 2011a. Surficial geology, geomorphology, granular resource evaluation and Till veneer; sand, silt and clay-rich diamictons; massive, matrix-supported and geohazard assessment for the Maxhamish Lake map area (NTS 94-O), northeastern British Columbia; compact; clast contents less than 20% and contain sub-rounded granitic Geological Survey of Canada, Open File 6883, 20 pages. erratic boulders with sources on the Canadian Shield; moderately to **CANADIAN GEOSCIENCE MAP 119** 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. well-drained; less than 2 m thick draping bedrock and older glacial deposits; transported and deposited by the Laurentide Ice Sheet directly through **SURFICIAL GEOLOGY** Geoscience Reports 2011, BC Ministry of Energy, pages 37-55. lodgement, basal meltout, glacigenic deformation beneath active, warm-based ice and in situ melting from stagnant cold-based ice; generally suitable for Huntley, D.H. and Sidwell, C.F., 2010. Application of the GEM surficial geology data model to resource evaluation **EMILE CREEK** infrastructure placement. and geohazard assessment for the Maxhamish Lake map area (NTS 94-O), British Columbia. Geological Survey of Canada, Open File 6553, 22 pages. Pre-Quaternary earth materials and landforms British Columbia Smith, I.R. and Lesk-Winfield, K., 2009. An integrated assessment of potential granular aggregate resources in Northwest Territories. Geological Survey of Canada, Open File 6058, 1 DVD-ROM. 1:50 000 Undifferentiated bedrock: conglomerate, sandstone, siltstone, shale and limestone; exposed in escarpments between 300 m and 80 km in length; Stott, D.F. and Taylor, G.C., 1968. Geology of Maxhamish Lake. Geological Survey of Canada, Map 2-1968, slopes above 10-15° with greater than 5 m relief prone to rock falls, topples rock slides and debris flows; Paleozoic unconformably overlain by Mesozoic rommelen, M. and Levson, V.M., 2008. Quaternary stratigraphy of the Prophet River, northeastern British sedimentary rocks; limestone and clastic sedimentary rocks are a potential Columbia; Canadian Journal of Earth Sciences, Vol. 45, pages 565-575. source of crushed granular aggregate. Recommended citation Huntley, D.H., Hickin, A.S., Chow, W., and Mirmohammadi, M., 2013. Surficial geology, Emile Creek, British Columbia; Geological Survey of Canada, Canadian Geoscience Map 119 (preliminary), scale 1:50 000. doi:10.4095/292396 122°30' **Preliminary CANADIAN GEOSCIENCE MAP 119 Preliminary Preliminary SURFICIAL GEOLOGY** n.gc. 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 zone 10. North American Datum 1983 M. Mirmohammadi M. Mirmohammadi corrections or additional information from users. **EMILE CREEK Geoscience Maps** This publication is available for free download through Geology by D.H. Huntley and A.S. Hickin (2009–2010) Base map at the scale of 1:50 000 from Natural Cartography by W. Chow 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 reliminary publications in Project as part of Natural Resources Canada's Geo Magnetic declination 2013, 20°32'E this series have not been mapping for Energy and Minerals (GEM) program decreasing 22' annually. scientifically edited.

Canada

CANADIAN GEOSCIENCE MAP 119

CANADIAN GEOSCIENCE MAP 119 SURFICIAL GEOLOGY EMILE CREEK British Columbia