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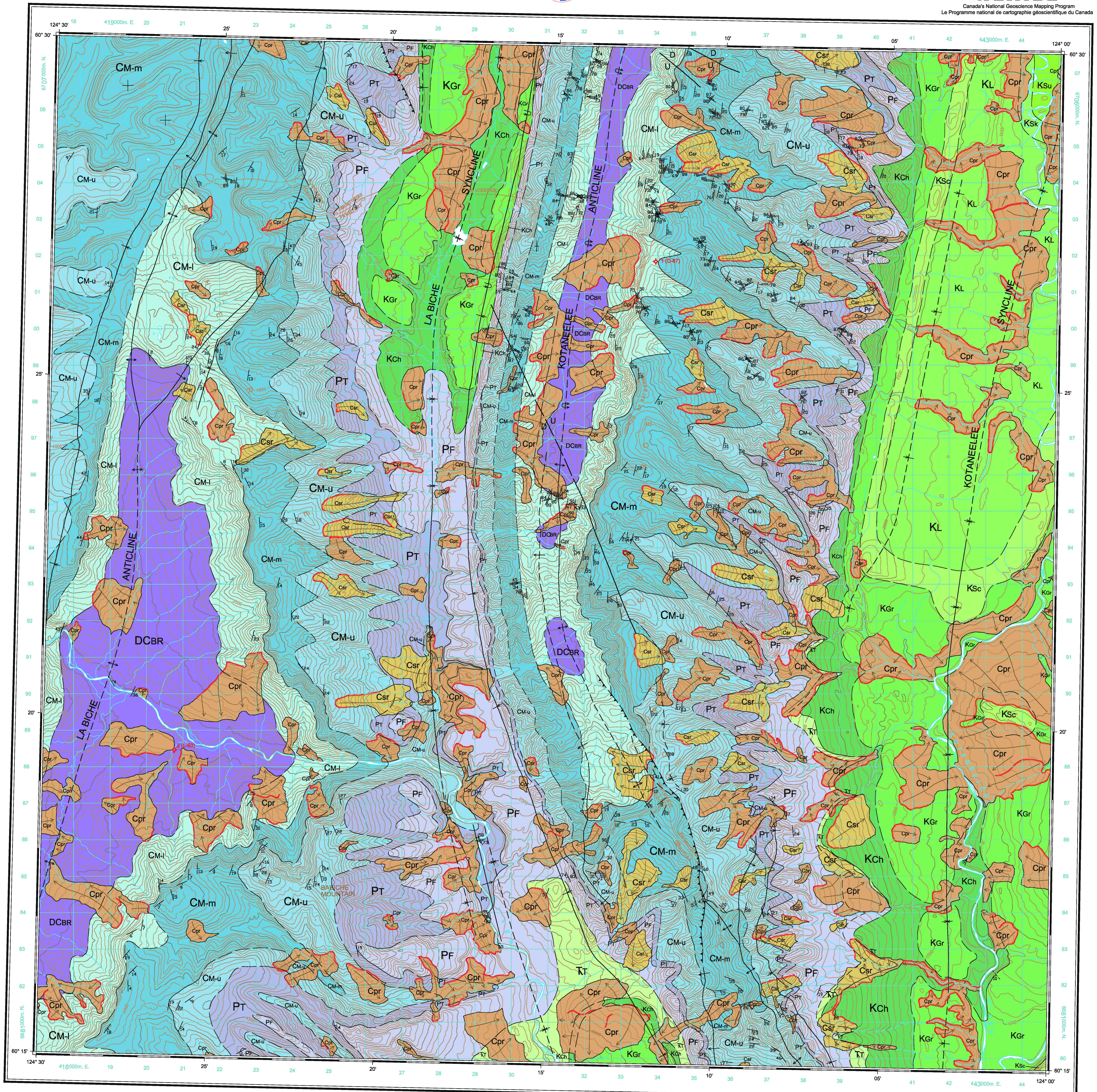
GEOLOGICAL SURVEY OF CANADA / COMMISSION GÉOLOGIQUE DU CANADA

NATMAP CARTNAT

Canada's National Geoscience Mapping Program
Le Programme national de cartographie géoscientifique du Canada



LEGEND

Coloured legend blocks indicate map units that appear on this map

QUATERNARY
SURFICIAL DEPOSITS

COLLUVIAL DEPOSITS: bedrock mass wasting debris, 1-50 m thick

Csr — ***Rock slide deposits:*** *chaotic landscape of irregular and stacked bedrock blocks; associated with steeply dipping, poorly-indurated sandstone and shale-rich beds in the Mattson and Fantasque formations*

Cpr — ***Rock slump deposit complexes:*** *stepped to chaotic landscape of bedrock debris; individual rotational blocks to a complex of slump blocks, translational slides, debris flows and other types of mass wasting; commonly traceable upslope to active scarps; where sufficient moisture is present, slumps may produce a flow at their base, forming a characteristic spatulate form; prominent in areas underlain by steeply dipping, poorly-indurated sandstone and shale-rich beds of the Mattson and Fantasque formations, and moderate to shallow dipping, shale-rich beds of the Fort St. John Group; associated with the largest mass movements in the region*

MESOZOIC

CRETACEOUS
LOWER CRETACEOUS
FORT ST JOHN GROUP (KCh-KSu)

KSu — ***SULLY FORMATION:*** *Dark grey shale and siltstone with sideritic concretions; silt content higher in upper part.*

KSk — ***SIKANNI FORMATION:*** *Greenish grey sandstone, siltstone, and shale; sandstone is thick-bedded, commonly calcareous or glauconitic; typically thinly laminated and cross-laminated.*

KL — ***LEPINE FORMATION:*** *Dark grey mudstone with concretions, silty shale, and black fissile shale; lower part of unit abundantly fossiliferous.*

KSc — ***SCATTER FORMATION:*** *Resistant, greenish-grey, glauconitic, laminated sandstone; medium- to thick-bedded; silty, concretionary mudstone common in middle part of unit.*

KGr — ***GARBUTT FORMATION:*** *Grey shale and siltstone with sideritic concretions; minor thin-bedded, finely laminated sandstone.*

KCh — ***CHINKEH FORMATION:*** *Chert-pebble conglomerate overlain by bioturbated quartz arenite with variable chert content, and argillaceous siltstone; woody or plant debris common.*

TRIASSIC
DIABER GROUP

TT — ***TOAD FORMATION:*** *Grey, red, and green shale interbedded with thin- to thick-bedded brown sandstone; locally calcareous or phosphatic; may include the Grayling Formation at the base.*

PALEOZOIC

PERMIAN
ISHBEL GROUP

PF — ***FANTASQUE FORMATION:*** *Dark grey to white, well bedded, spiculitic chert; rusty weathering; rhythmically interbedded with minor shale and siliceous siltstone.*

PT — *Tika map unit: Buff weathering, light to medium brown, silty and sandy limestone or dolostone grading into calcareous siltstone and sandstone; subordinate lithoclast breccia and shale; medium-bedded, massive to crosslaminated; sparsely fossiliferous; characteristic rectilinear fracture pattern.*

CARBONIFEROUS
LOWER CARBONIFEROUS
MATTSON FORMATION

CM-u — ***UPPER MEMBER:*** *Light to medium grey, fine- to coarse-grained, locally calcareous or dolomitic quartz arenite and sub-chert-arenite; subordinate fossiliferous limestone, and grey to green shale; sandstone commonly shows large-scale crossbedding; fossils in the limestone are commonly silicified; may include Tika map unit.*

CM-m — ***MIDDLE MEMBER:*** *Grey to buff to brown, poorly- to well-indurated, fine-grained quartz arenite with subordinate siltstone and dark shale; minor coal and sandy dolostone; sandstone shows fine- to large-scale crossbedding; typically forms sharp-based, thick-bedded, fining-up sequences.*

CM-l — ***LOWER MEMBER:*** *Greyish orange weathering, light grey or buff, well-indurated, fine- to very fine-grained quartz arenite interbedded with siltstone and dark grey shale; minor coal, dolostone, and lithoclast breccia; crosslaminae and trace fossils common, typically thin- to medium-bedded with coarsening-up sequences.*

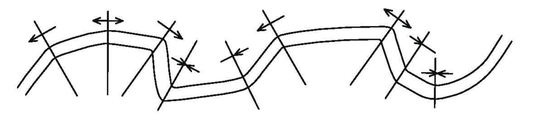
DEVONIAN AND CARBONIFEROUS

DCBR — ***BESA RIVER FORMATION:*** *Dark grey to black shale, locally weathers buff; sparsely fossiliferous; minor interbedded greyish-orange weathering sandstone, siltstone, lithoclast breccia, and scattered sideritic nodules.*

MAP SYMBOLS

- *Landslide boundary*
- *Scarp*
- *Landslide flow path*
- Geological boundary (defined, approximate, assumed)
- Bedding (inclined, vertical, horizontal, overturned, estimated)
- Joints
- Anticline (defined, approximate, assumed)
- Syncline (defined, approximate, assumed)
- Overturned anticline (defined, approximate, assumed)
- Anticlinal kink fold (defined, approximate, assumed) (See diagram below)
- Synclinal kink fold (defined, approximate, assumed) (See diagram below)
- Overturned syncline - limbs dip in opposite direction (defined, approximate, assumed)
- Fault, thrust (defined, approximate)
- Fault, unknown type (defined, approximate) (U on upthrown side, D on downthrown side)
- Wells (dry and abandoned)

FOLD SYMBOLOGY



Cross-section view: double arrows are used to indicate folds where the dip direction changes across the hinge, and single arrows are used where the dip direction remains the same across a hinge

LIST OF WELLS

	UWID	FULL NAME	SPUD DATE	SURFACE LOCATION (Easting, Northing)
1	300O676030124000	PAN AM KOTANEELEE O-67	19 NOV 1968	433957, 6701843
2	300L606020124150	PAN AM SHELL MERRILL YT L-60	24 JAN 1969	420758, 6688465

NOTE:

Mass Wasting *is the collective term given to the range of processes and resultant landforms that relate to the gravitational downslope movement of rock and/or unconsolidated material without direct conveyance by water, air or ice. Water and ice are, however, commonly key components in initiating and perpetuating mass wasting by reducing the strength of materials and in their plastic and fluid behaviour.*

Different types of mass wasting are distinguished by the type of materials involved (e.g., bedrock, talus, till), the mode of deformation (e.g., creep, slide, slump, flow), speed of movement, morphology of the moving mass, and water content. Many mass wasting events which are initiated in bedrock also incorporate considerable surficial deposits in their motion (particularly in valleys where glacial deposits may be thicker; Smith, 2003), producing a complex of mass wasting deposits.

While different earth surface materials and geological settings may be strongly associated with various types of mass wasting, predicting their occurrence, magnitude and rate of deformation is often not possible. Some areas that are prone to mass wasting in the Babiche Mountain region include areas of steep to moderately dipping bedrock, poorly indurated and shale-rich bedrock, and along stream courses and meandering river channels. Human activities such as road building, pipeline trenching, logging and seismic exploration can also initiate mass wasting, particularly where they undercut slopes, or act to destabilize surficial materials.

Rock Slides *are the rapid, downslope movement of bedrock. Failure occurs along bedding and/or joint planes. Slides can be initiated at shallow or considerable depths. Rock slides cover* **25.0 km²** *(~3.2 % of the total map area). They are found principally within the middle and upper Mattson Formation, but also occur in Toad, Fantasque and Chinkeh formations. There is a conspicuous spatial pattern of rock slides along the eastern limb of Kotaneelee Anticline, and to a lesser degree, the eastern limb of La Biche Anticline. In the northern half of the map, ridges of bedrock extend obliquely across strike, southeast from the axis of Kotaneelee Anticline. This creates a situation wherein beds of Mattson Formation and other strata have a down-dip component parallel to the northeast-trending surface slope of the ridge. Interaction of bedding and jointing planes facilitates failure in shale and/or poorly lithified sandstone beds, leading to large rock slides. In the south half of the map, Kotaneelee Anticline is deflected to the southeast. Bedrock ridges extend eastward, oblique to strike, producing the same bedrock geometry as seen in the northern map area, resulting in active rock slides along northeast-facing ridge slopes. Along the central part of the gently northward plunging La Biche Anticline, rock slides are also found along northeast-facing ridge slopes. Their less common occurrence here may reflect generally shallower dipping Mattson Formation strata.*

Rock Slumps *involve the rotational movement of bedrock along failure planes. Slumps may occur as individual blocks or amorphous masses (reflecting water content and structural integrity of the failing material). Slumps often extend progressively up-slope through time, and can be associated with active scarp or headwall retreat. Slumps can be initiated by failure along bedding or joint planes, by infiltration of surface water, through lateral incision and undercutting of slopes by streams, or excavation activities. Rock slumps cover* **116.5 km²** *(~15.0% of the total map area) and are the most extensive form of mass wasting in the map area (see Smith, 2003). Found in all of the different rock formations present in the 95C/8 map, they are particularly prominent in Garbutt and Lepine formation shale and siltstone, as well as in Tika map unit, Besa River Formation and upper Upper Mattson Formation strata. Many slumps are clearly aligned perpendicular to strike, suggesting that they are generated by failure along bedding planes, possibly within shale or other poorly indurated beds. Slumps are also common along the southwest-facing sides of ridges extending eastward from Kotaneelee Anticline. In many ways this reflects an opposite geometry to that associated with rock slides along these same ridges, and serves to illustrate the often simple bedrock structural control of different types of mass wasting (i.e., beds parallel to slope producing rock slides, beds perpendicular or oblique to slope producing rock slumps). Elsewhere, slumps have, and continue to be generated by the undercutting of slopes by the La Biche and Kotaneelee rivers. This is particularly evident along the Kotaneelee River where many relict and active slumps are found. Diversion and/or temporary damming of the La Biche and Kotaneelee rivers by large slumps generated along the valley sides represents a considerable, albeit rare, hazard in this region.*

In attempting to discern where exactly slumps were initiated, it is important to recognize that the location of scarps does not neccessarily coincide with the geological/structural failure surface. Many of the slumps seen in this map involve considerable depths of material, indicating that the slumps are being triggered in strata underlying that exposed at the surface. This is perhaps best illustrated along the eastern limb of Kotaneelee Anticline where many slumps which extend upslope through the Toad Formation were likely generated by failure within Fantasque Formation (or possibly within shales of Grayling Formation, which if present in the map area, would be found immediately beneath Toad Formation). The same type of associations are found throughout Mattson Formation strata.

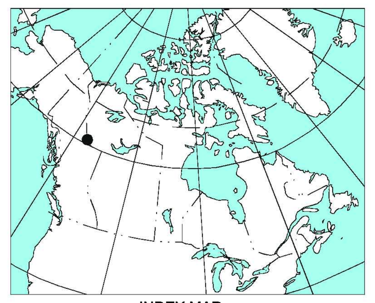
Scarps/headwalls bounding the lateral and upper margins of slumps within Mattson Formation often display a marked orthogonal and/or rectilinear pattern. These patterns are strongly correlative with measured strike and joint orientations. Since jointing is particularly well developed in sandstone beds of Mattson Formation, these structural associations likely contribute to regional mass wasting trends and the block-failure of bedrock. Retrogressive landslides which propagate upslope after initial bedrock failure, or when slumps are reactivated, are also likely to be strongly correlated with these structural associations.

Many bedrock slumps in the map area are classified as rotational-slumps (particularly in Mattson and Fantasque formation strata). These slumps have a longitudinal profile which shows a steep slope in the upper third to two-thirds, an inflection, and then a more gentle slope through the lower reaches. This morphology reflects the failure of bedrock at depth, the backward and down-slope rotation of bedrock above the failure surface, and the run-out of slumped material downslope. In these cases, the inflection can be used to estimate where the bedrock failure surface was located. On a regional scale, in areas where bed strike and dip remain relatively constant, it may be possible to infer areas of potential future failure (and apply this to possible development considerations). Clearly, such a scheme is dependent on several assumptions including those of lateral bed continuity and compositional homogeneity. Regional drilling activities may ultimately be able to resolve these, by specifically identifying which bed is responsible for triggering the failures. This knowledge could then be applied to larger regional studies, tracing the same bed, and assessing the potential for failure for a given stratigraphic and topographic locale.

REFERENCES

Fallas, K.M., and Lane, L.S. (compilers)
2003: Geology, Babiche Mountain (95C/8), Yukon and Northwest Territories; Geological Survey of Canada, Open File 1563, 1 map, scale 1:50 000.

Smith, I.R.
2003: Surficial Geology, Babiche Mountain (95C/8), Yukon Territory and Northwest Territories; Geological Survey of Canada, Open File 1558, 1 map, scale 1:50 000.



INDEX MAP

CONTOUR INTERVAL 100 FEET
Elevations in Feet above Mean Sea Level

OPEN FILE 1752

LANDSLIDES AND BEDROCK GEOLOGY ASSOCIATIONS

BABICHE MOUNTAIN

YUKON TERRITORY - NORTHWEST TERRITORIES

Scale 1:50 000/Échelle 1/50 000

Kilometres 1 0 1 2 3 Kilomètres

Universal Transverse Mercator Projection
North American Datum 1983

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1983

Compilation by K.M. Fallas, L.S. Lane and I.R. Smith based on fieldwork and studies of vertical air photographs 2000-2002.
THIS IS A PRODUCT OF THE CENTRAL FORELAND NATMAP PROJECT

Surficial geology by: I.R. Smith, 2000-2002;
Bedrock Geology by: K.M. Fallas, L.S. Lane, and A.K. Khudoley, 2000-2002;
L.D. Currie, T.E. Kubli, M.P. Cecile, and M.R. McDonough, 1995-1997;
based on fieldwork and studies of vertical air photographs.

Digital cartography by I.R. Smith and S.J. Hinds.

Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada.

Base map at the same scale published by Surveys and Mapping Branch in 1971.

95C/10 Tika Creek	95C/9 Chinkeh Creek	95B/12 Mount Flett
95C/7 Brown Lake	95C/8 Babiche Mountain GSC OF 1752	95B/5 Fisherman Lake
95C/2 Mount Merrill GSC OF 4328	95C/1 Mount Martin GSC OF 4335	95B/4 Betalamea Lake

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

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1752
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COMMISSION GÉOLOGIQUE DU CANADA
2003

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Les dossiers publics sont des produits qui n'ont pas été soumis au processus officiel de publication de la CGC.

Recommended citation:
Smith, I.R., Fallas, K.M., and Lane, L.S.
2003: Landslides and Bedrock Geology Associations, Babiche Mountain (95C/8), Yukon Territory - Northwest Territories; Geological Survey of Canada, Open File 1752, 1 map, scale 1:50 000.

Canada