Descriptive Notes

Physiography and drainage
The main physiographic feature in this map area is the junction of the Takhini and Yukon river valleys. North of the Takhini River is the Yukon Plateau and more specifically, the southern extent of the Miners Range. South of the Takhini River is the Boundary Ranges of the Coast Mountains.

The Yukon River captures the Takhini River and flows northward into Lake Laberge. A prominent delta of the Yukon River is built out into Lake Laberge. Another important drainage in the map area is Flat Creek which flows southward into the Takhini River.

The McConnell Glaciation in the Whitehorse area
During the Late Wisconsinan McConnell Glaciation (~20 000 years ago), the Whitehorse map area (NTS 105D) was glaciated by ice lobes originating in the Coast Mountains and the Cassiar Mountains of southern Yukon. Initial ice accumulations in the map area probably began in the higher regions of the Coast Mountains. It was not until localized ice caps had formed that the more distal Cassiar Lobe advanced into the map area from the southeast through Marsh Lake valley. The convergence of the two lobes at glacial maximum occurred over the Coast Mountains west of the city of Whitehorse. At the height of the last glaciation, movement of ice over this area was to the northwest and was unobstructed by topography. Adjacent to the Alaska Highway near the hamlet of Ibex Valley, evidence of ice-flow directions from this period of the glaciation are recorded on polished bedrock surfaces as glacial striae.

The pattern of deglaciation is highlighted by periods of differential retreat and fluctuating ice fronts. A re-advance of the Cassiar Lobe occurred into this area and had a significant influence on sediment deposition on the landscape. In particular, systems of pro-glacial lakes developed marginally to the Cassiar Lobe in the Takhini River and Lake Laberge valleys as it retreated. The glacial lake in the Takhini River valley, also known as Glacial Lake Champagne, during its latest stage drained northward via the headwaters of the Nordenskiold River. This outlet maintained a maximum water level of 746 m a.s.l. or about 100 m (328ft.) depth. Glacial Lake Laberge developed behind a sediment dam at the far north end of the present lake (this natural dam still controls the water level in the lake). The outlet through the sediment dam has since dropped due to erosion but at its maximum level the depth of Glacial Lake Laberge was 73 m (239 ft.) above the current shoreline. The water depth over the city of Whitehorse was likely <5 m deep.

Landforms
Takhini River valley
As the glacier front retreated to the east out of the Takhini River valley, it periodically paused and deposited large end moraines (Figure 1; see the moraine symbol on the map). The curvature of these landforms reflects the shape of the ice margin at the time of deposition. These moraines are a good aggregate resource in a valley bottom that is otherwise devoid of coarse sediment (see station JB-03-002 on map).

The dominant landforms in the Takhini River valley are the plains that once formed the bottom of Glacial Lake Champagne. The Takhini River has since down-cut into these silty deposits (Figure 2; see "LG" on the map) and exposed the depositional layering from within the former lake. Side tributaries entering the Takhini River from the south also cut impressive canyons into the glacial lake bed sediments.

Scout Lake valley
The glacier that filled the Takhini River valley spilled into the Scout Lake valley. As this glacier retreated large meltwater channels were carved into the valley sides (Figure 3; see meltwater channel symbols). Many of these channels are very large and attest to the quantity and force of water draining off the melting glaciers.

Lake Laberge and Yukon River valley
Like the Takhini River valley the dominant landforms in the Yukon River valley are glacial lake plains. On the west side of the Yukon River these plains are visible from the North Klondike Highway. The reduction in lake levels in this valley has been ongoing since their initial high stand following glacial retreat to the present day level of Lake Laberge. This is due to the continual erosion of the sediment dam at the north end of Lake Laberge. Evidence of this progressive lake level reduction is visible along the North Klondike Highway between Takhini Hot Springs Road and Shallow Bay Road. The highway traverses over terrace edges which represent former shorelines of Lake Laberge (see strandline symbol). As you drive north, the shorelines become lower in elevation until you reach the modern shoreline at Shallow Bay. Shorelines are also visible immediately north of the Horse Creek road near its junction with the North Klondike Highway. Other evidence of former shorelines is preserved as beach ridge dunes on the east side of the Yukon River near Swan Lake and the Livingstone Trail. These beaches formed on a south-facing shoreline that was part of a former bay of Lake Laberge, similar to Shallow Bay today. This shoreline has an age of 10000 +/- 1000 years old. A sand spit that developed from river currents entering this former bay is well preserved in Swan Lake and forms a point out into the lake (Figure 4).

Following glacial retreat, the reduction in lake levels in the Yukon River valley exposed the former lake bottom surface. During this time the winds coming off the retreating glaciers to the south were strong and began reworking the lake bottom sediments into parabolic dunes (see Eolian materials on the map). The last period of eolian activity (active dunes) in the Whitehorse dune field was approximately 9100 +/- 1000 years ago. At this time the wind strength probably waned and vegetation stabilized the land surface. While the largest dunes are located east of the Yukon River near the Livingstone Trail there are also smaller dunes visible in North Klondike Highway road cuts, immediately north of the Takhini Road junction.

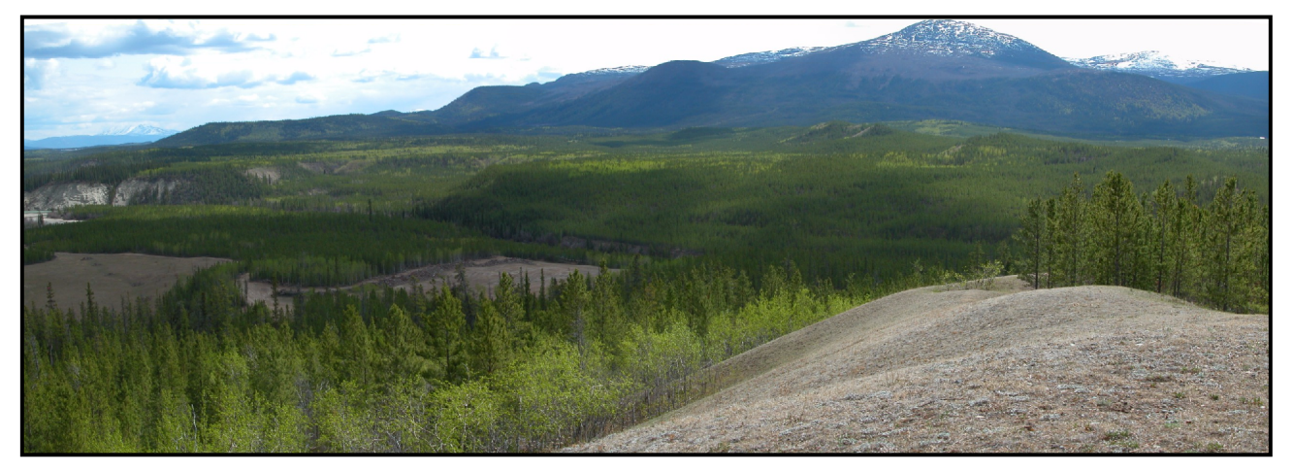


Figure 1. A view south across the Takhini River valley towards Haeckel Hill. A recessional moraine and its well-drained surface is visible in the foreground. The moraine ridge is visible across the valley. The terrace surface to the left of the moraine is made up of glaciolacustrine plains.

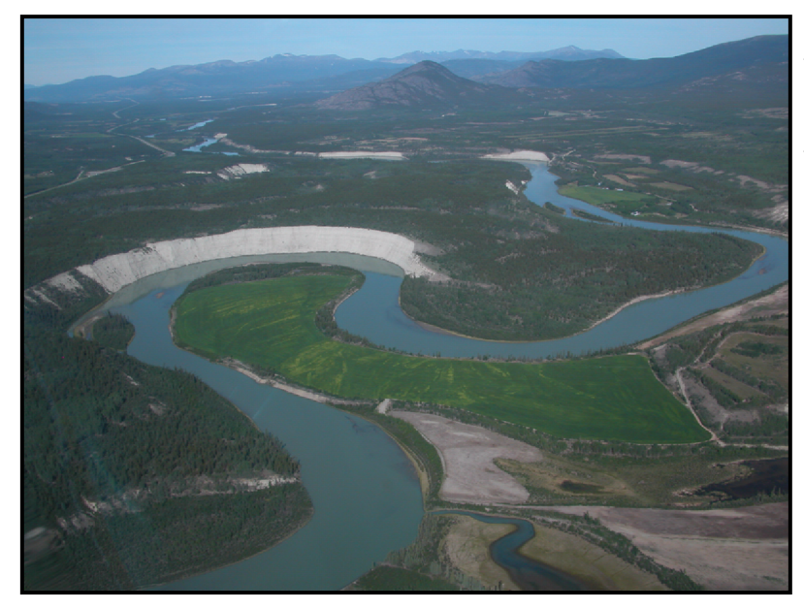


Figure 2. An aerial view to the west up the Takhini River valley. The glaciolacustrine plains are exposed by down-cutting of the Takhini River. The fine-grained fluvial deposits that make up the Takhini River floodplain have been developed for agricultural purposes.

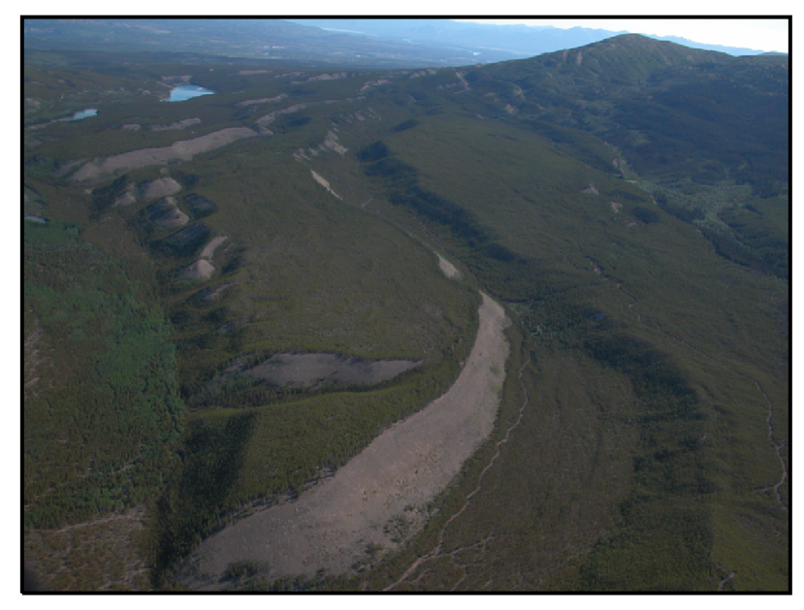


Figure 3. An aerial view to the northeast from the Scout Lake valley. Scout Lake is visbile in the background left. The deeply incised channels are remnant of ice-marginal glacial meltwater erosion. These channels were cut when a tongue of ice from the Takhini River valley spilled into the Scout Lake valley during glacial recession.

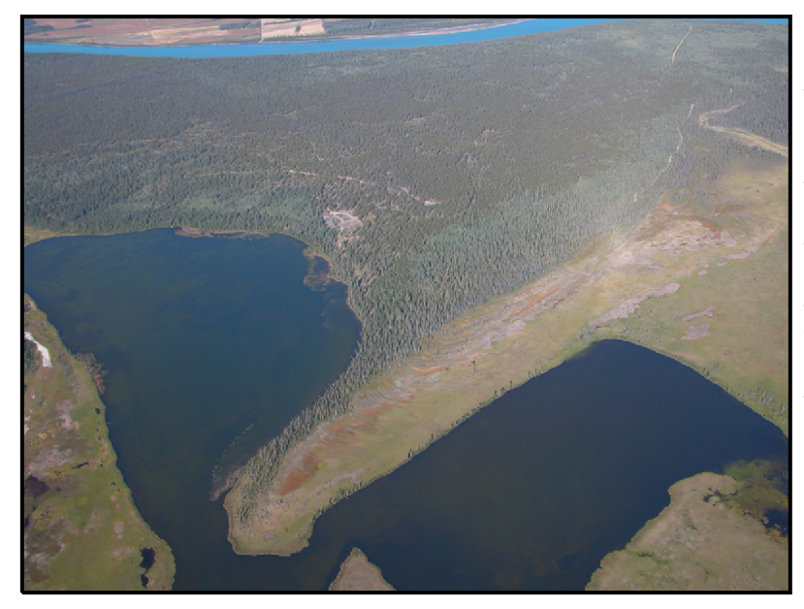
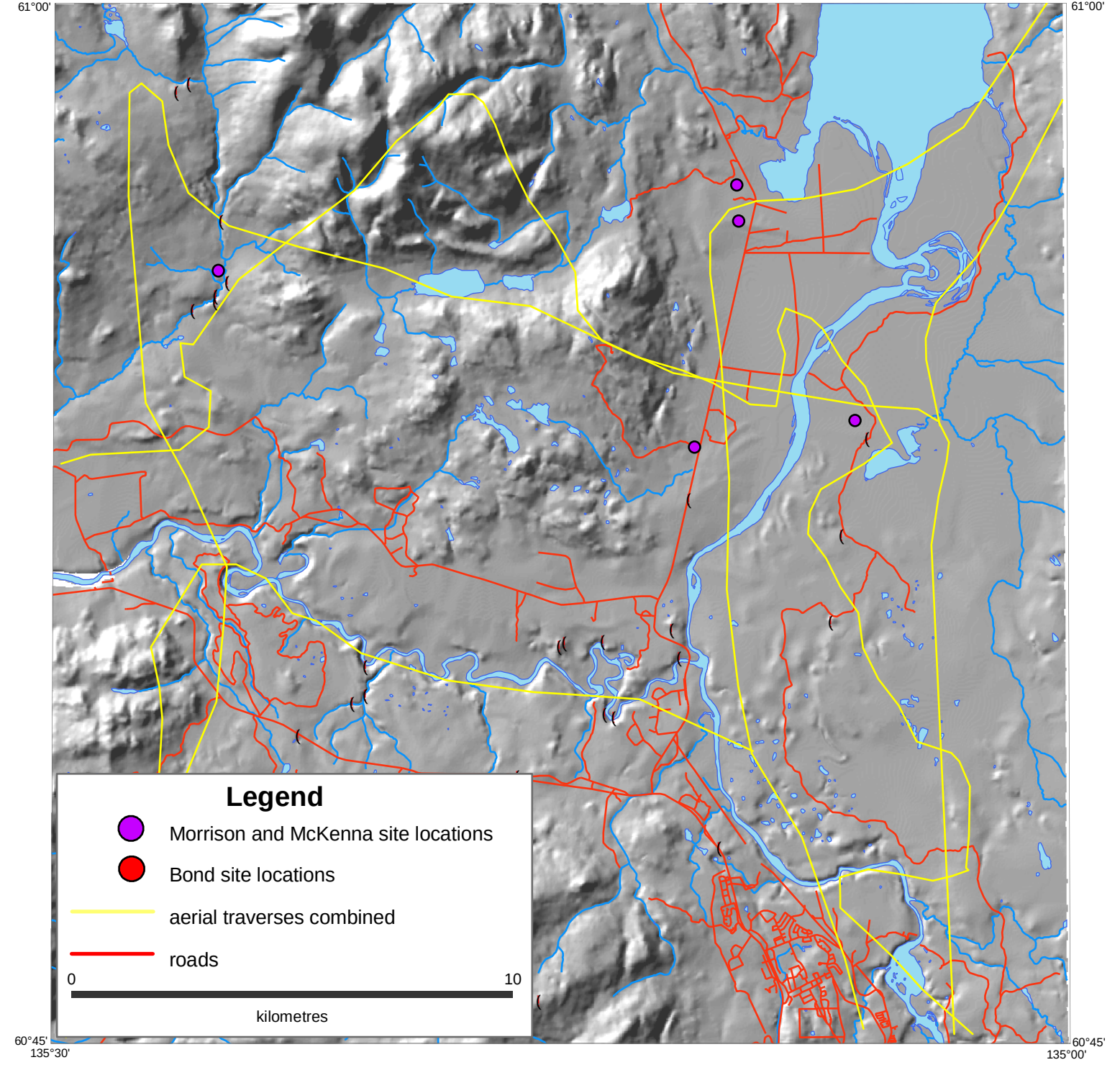
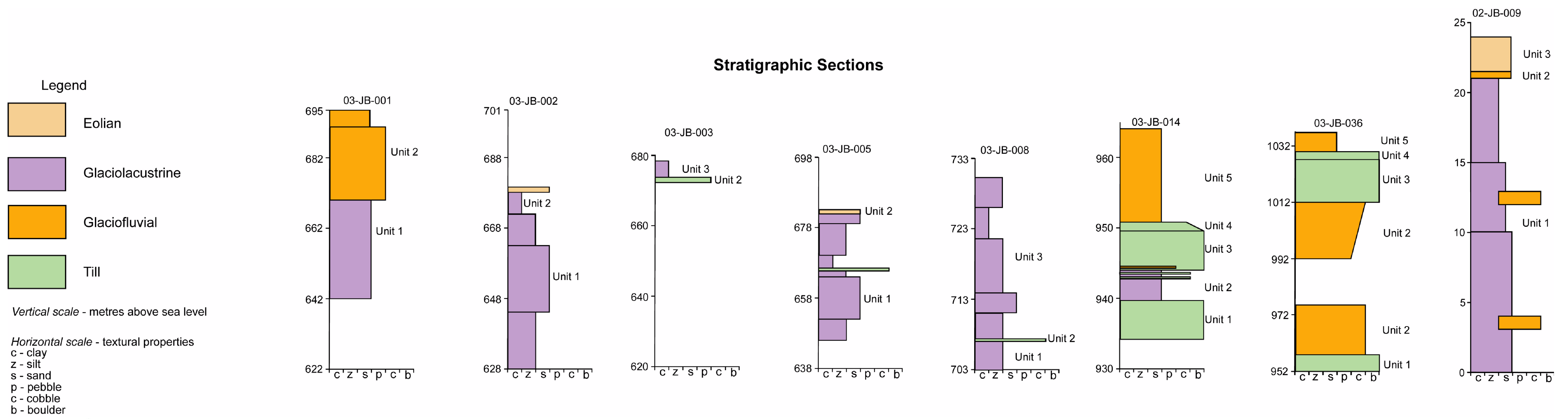


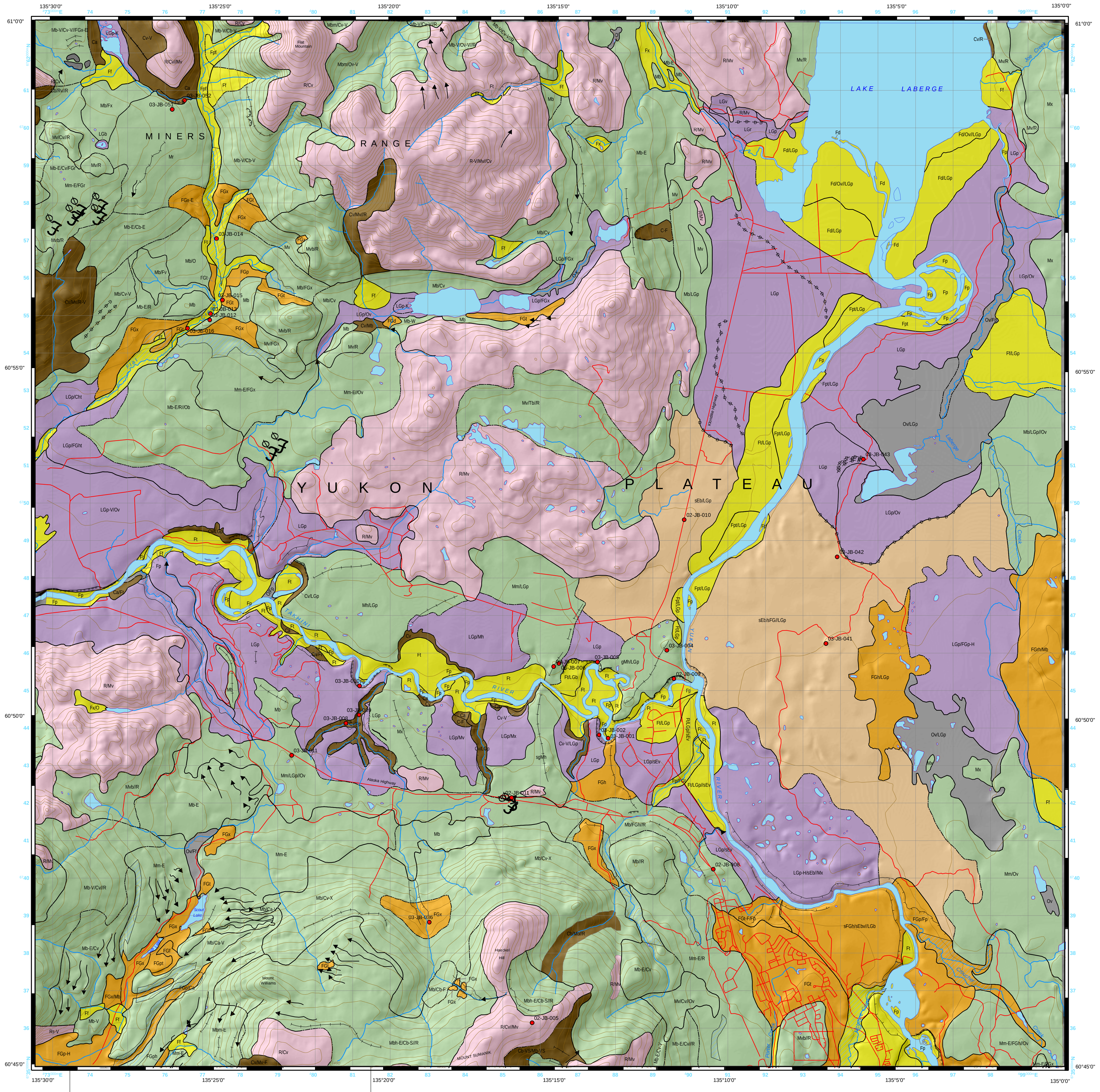
Figure 4. An aerial view looking down on Swan Lake. The Yukon River is visible in the background. The point of land extending out into Swan Lake is a relict sand spit. It was active when the water level in Lake Laberge was higher and the southern shoreline of the lake was positioned in this area. Swan Lake would have been a bay that was connected to Lake Laberge. The sand spit is remnant of a water current that was depositing sand into this former bay.

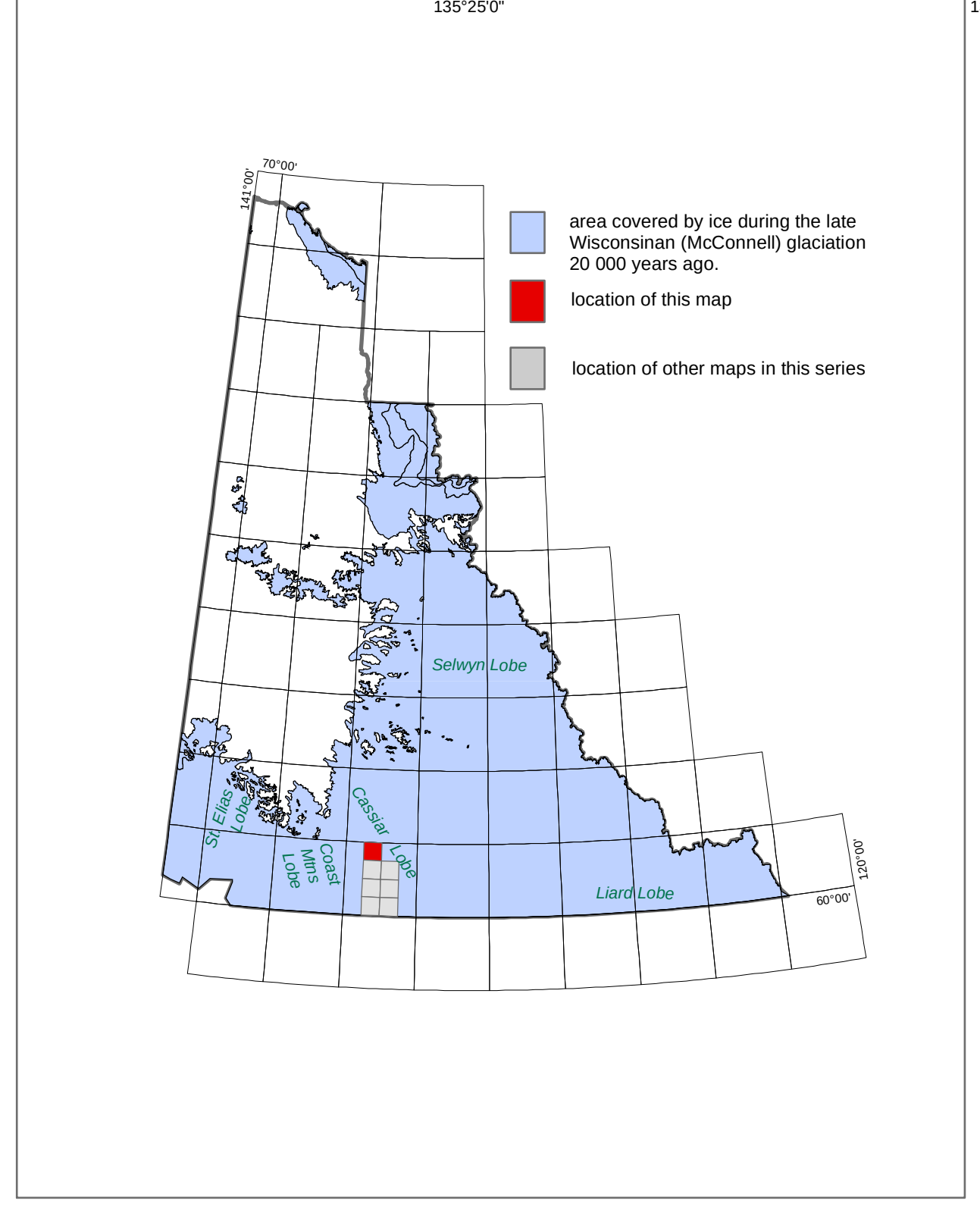
Aerial Traverse and Site Locations



Stratigraphic Sections






70°00'
141°00'
area covered by ice during the late Wisconsinan (McConnell) glaciation 20 000 years ago.
location of this map
location of other maps in this series
Selwyn Lobe
St. Elias Lobe
Coast Mtns Lobe
Cassiar Lobe
Liard Lobe
120°00'
60°00'

SURFICIAL GEOLOGY
UPPER LABERGE
YUKON

SCALE 1:50 000

1 0 1 2 3 4
kilomètres kilometres

CONTOUR INTERVAL 40 METRES
Elevation in metres above Mean Sea Level
North American Datum 1983
Universal Transverse Mercator

1:50 000-scale topographic base data
produced by
CENTRE FOR TOPOGRAPHIC
INFORMATION,
NATURAL RESOURCES CANADA

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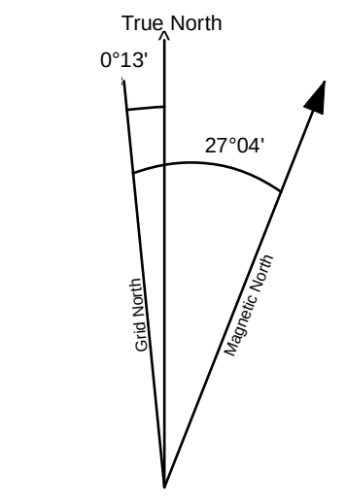
ONE THOUSAND METRE
Universal Transverse Mercator Grid
Zone 8

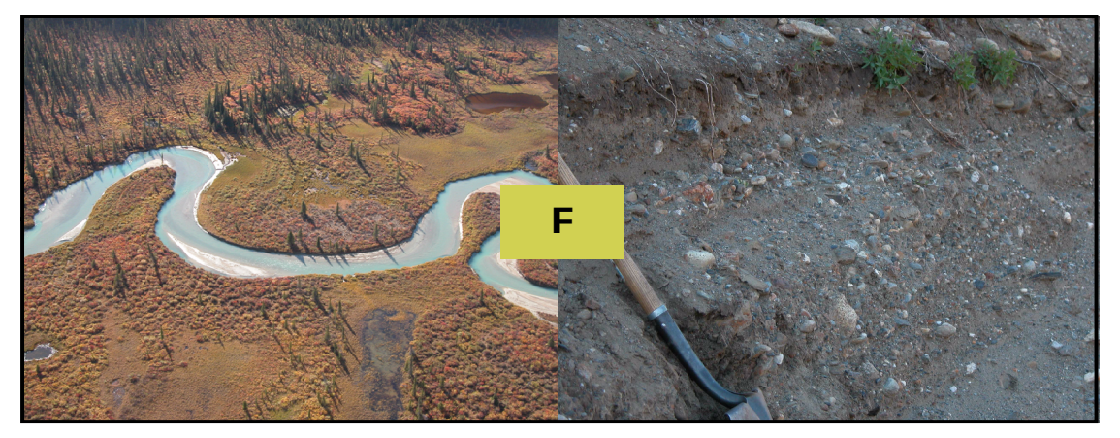


Use diagram only to obtain numerical values
APPROXIMATE MEAN DECLINATION 2000
FOR CENTRE OF MAP
Annual change decreasing 11.5'

Legend

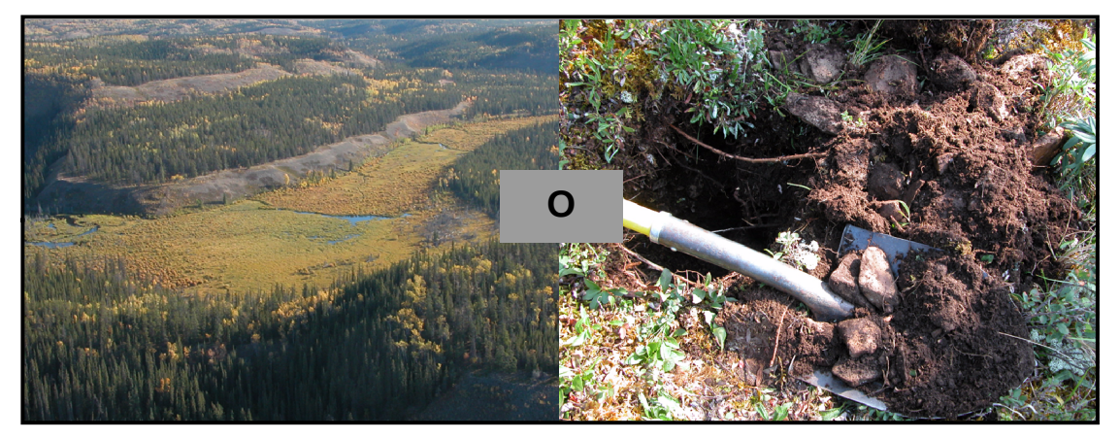
QUATERNARY

HOLOCENE



Fluvial Deposits: Sediment transported and deposited by streams and rivers; synonymous with alluvial. General Description: deposits consist of gravel and/or sand and/or silt (and rarely clay). Gravel is typically rounded and contains interstitial sand. Fluvial sediment is commonly moderately to well-sorted and displays stratification, although massive, nonsorted fluvial deposits do occur. Fluvial deposits in the large valley bottoms typically have a sandy texture because of the abundance of reworked glaciolacustrine sediment. Includes floodplains, fluvial terraces and fans, and deltas.

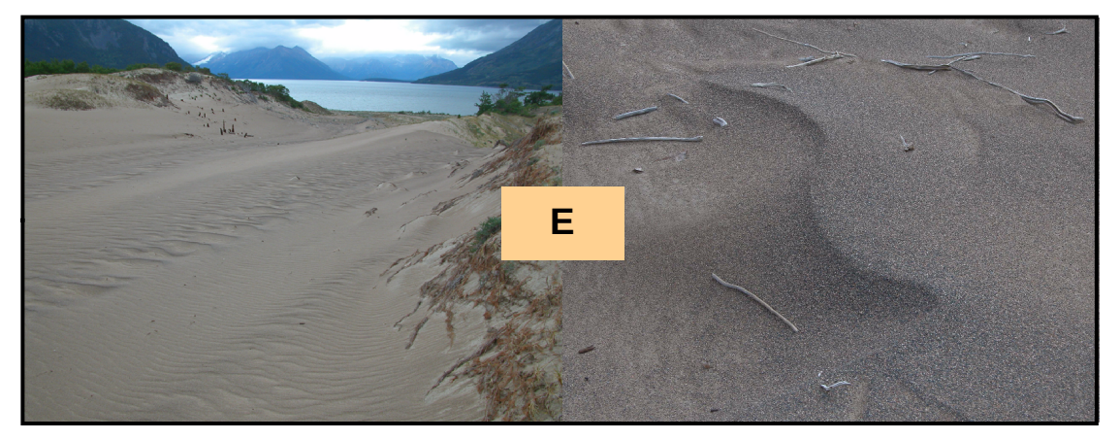
The landform photograph shows the upper Wheaton River floodplain and fluvial sediment. The active components of the floodplain have minimal vegetative cover, whereas older, less active sections of the floodplain are well vegetated.



Organic Deposits: Materials resulting from vegetative growth, decay and accumlation in and around closed basins or on gentle slopes, where the rate of accumulation exceeds that of decay. Two types of organic material are recognized. The first are commonly saturated with water and consist mainly of the accumulated remains of mosses, sedges or other hydrophytic vegetation. The second are rarely saturated with water and consist typically of leaf litter, twigs, branches and mosses (folisols).

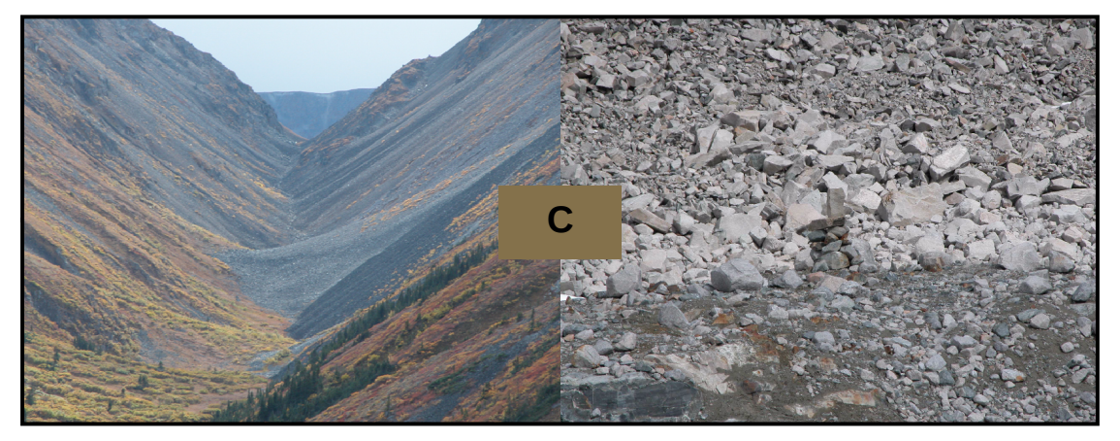
The landform photograph shows an inactive channel of the Yukon River near the mouth of Cowley Creek. Organic deposits have accumulated in the poorly drained abandoned river channel.

PLEISTOCENE AND HOLOCENE (UNDIVIDED)



Eolian Deposits: Sediment transported and deposited by wind action. General Description: consists of medium to fine sand and coarse silt that is well-sorted, noncompacted and may contain internal structures such as crossbedding or ripple laminae, or may be massive. Individual grains may be rounded and exhibit frosting. Eolian landforms may be active (Carcross dunes) or vegetated and inactive (Whitehorse dune field).

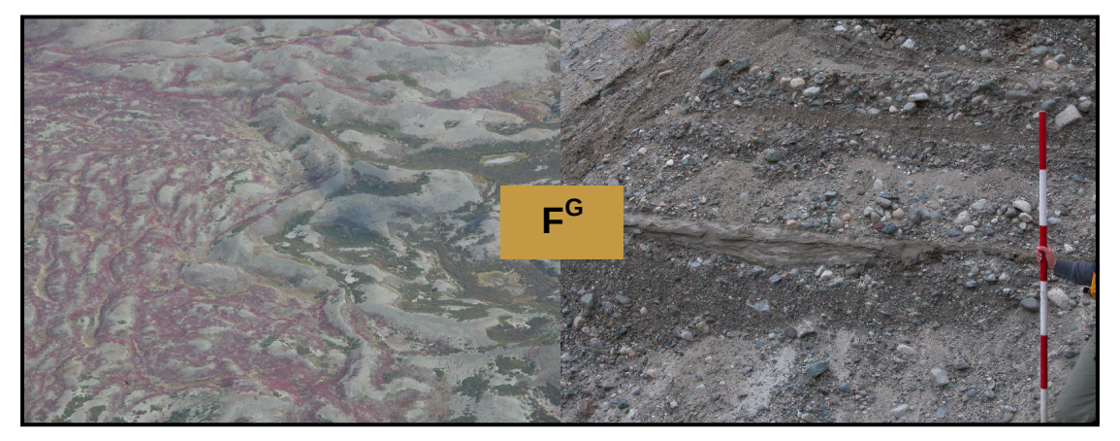
The landform photograph shows active dunes along the shoreline of Bennett Lake near the town of Carcross. Most eolian deposits in the map area are inactive. The Whitehorse dune field was last active between 9000 and 10 000 years ago.



Colluvial Deposits: Sediments that have reached their present position as a result of direct, gravity induced movement involving no agent of transportation such as water or ice, although the moving material may have contained water and/or ice. General Description: consists of massive to moderately well stratified, nonsorted to poorly sorted sediments with a range of particle sizes from clay to boulders and blocks. The character of any particular colluvial deposit depends upon the nature of the material from which it was derived and the specific process whereby it was deposited.

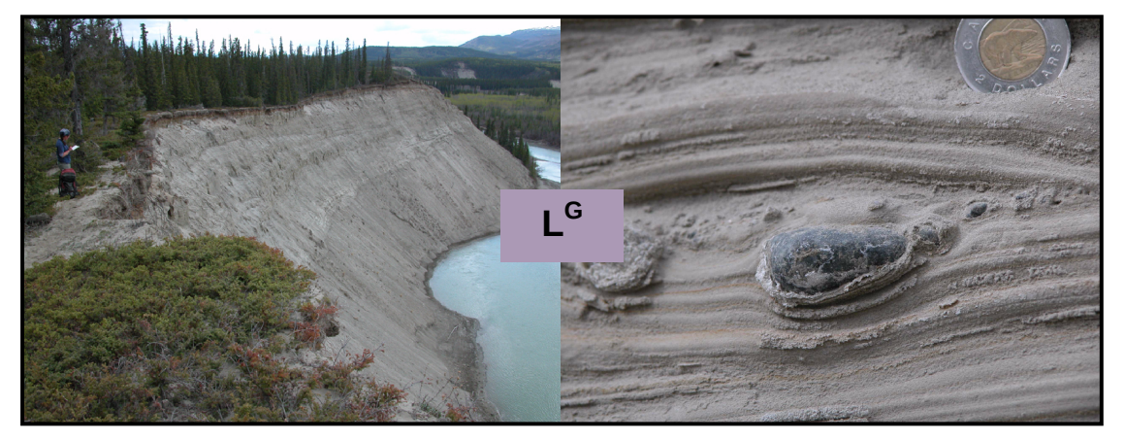
The landform photograph shows active colluviation into a meltwater channel east of Lake Laberge. The colluvial deposit depicted in the textural photograph originated from lateral moraine sediment of the Little Ice Age advance in the Wheaton River valley.

LATE PLEISTOCENE (WISCONSINAN) McCONNELL GLACIATION



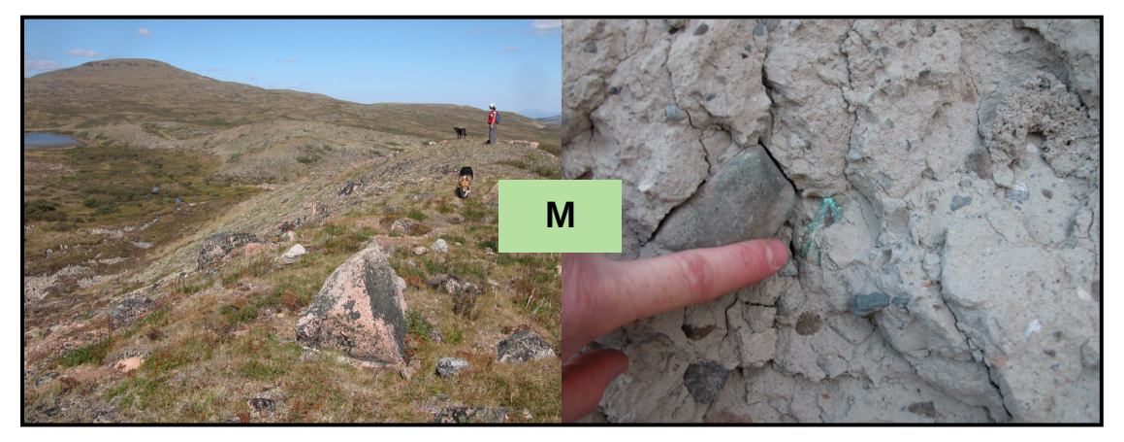
Glaciofluvial Deposits: Fluvial materials that exhibit clear evidence of having been deposited by glacial meltwater streams either directly in front of, or in contact with, glacier ice. General Description: glaciofluvial sediment typically ranges from nonsorted and nonbedded gravel made up of a wide range of particle sizes, such as that resulting from very rapid aggradation at an ice front, to moderately to well-sorted, stratified gravel; flow tills may occur in some deposits. Slump structures and/or equivalent topographic expression, such as hummocky, kettled or irregular terrain may be present. These features are indicative of collapse of the material due to melting of supporting ice. Includes pitted outwash plains, kames and eskers.

The landform photograph shows an esker located southwest of Whitehorse near Fish Lake. Eskers are sinuous glaciofluvial ridges deposited by streams that were once flowing under a former glacier.



Glaciolacustrine Deposits: Lacustrine sediment deposited in or along the margins of glacially fed lakes; includes sediments that were released by the melting of floating ice. General Description: glaciolacustrine sediments include: 1) lake bed sediments consisting of stratified fine sand, silt and/or clay; they commonly contain ice-rafted stones and lenses of till and/or glaciofluvial material; slump structures and/or their topographic expression, such as hummocky, kettled or irregular terrain, may be present and are remnant of collapse of the material due to melting of supporting ice, and 2) moderately sorted to well sorted, stratified sand and coarser beach sediments transported and deposited by wave action along the margins of glacial lakes.

The landform photograph depicts glaciolacustrine sediment along the Takhini River valley. The pebble in photograph 2 was ice-rafted out into the former lake and subsequentely dropped onto the lake bed when the ice-raft melted.



Glacial Deposits (Till): Sediment deposited directly by glacier ice without modification by any other agent of transportation. General Description: till can be transported beneath, beside, on, within and in front of a glacier. The mineraological, textural, structural and topographic characteristics of till deposits are highly variable and depend upon both the source of material incorporated by the glacier and the mode of deposition. In general, till consists of well compacted to noncompacted material that is nonstratified and contains a heterogeneous mixture of particle sizes, commonly in a matrix of sand, silt and clay.

The landform photograph shows a lateral moraine that is composed of coarse, blocky till in the Wolf Creek drainage. The textural photograph displays an exposure of compact lodgement till on the copper haul road in the city of Whitehorse. A malachite-rich pebble is visible near the centre of the photograph.

PRE-QUATERNARY (UNDIVIDED)

Bedrock: Bedrock outcrops and rock covered by a thin mantle of unconsolidated or organic materials. Rocks in the Whitehorse area are part of a Mesozoic sedimentary basin known as the Whitehorse Trough (Wheeler, 1961; Lowey, 2005). These rocks largely consist of volcanic, volcaniclastic, clastic and carbonate rocks of the Lewes River Group (Upper Triassic); volcaniclastic, clastic and coal of the Laberge Group (Lower-Middle Jurassic); and clastics and coal of the Tantalus Formation (Upper-Lower Cretaceous; Wheeler, 1961; Lowey, 2005). Large areas of the sedimentary sequence were subsequently intruded by granitic rocks during the Cretaceous. Tertiary basalt flows occur within the city of Whitehorse, north of Alligator Lake and in the Wheaton River valley. Photograph on the far left shows a glacially sculpted outcrop of Lewes River Group limestone. The photograph on the adjacent left shows striated granite recently deglaciated near the headwaters of the Wheaton River.

Terrain Classification

1st terrain classification 50-100% of map unit / 2nd terrain classification 30-45% of map unit // 3rd terrain classification 10-25% of map unit

sMbv-EV$_S$
- geomorphological process(es) (channeled, gullied)
- surface expression(s) (blanket, veneer)
- surficial material (till)
- texture (sandy)

SURFACE EXPRESSION

Surface expression refers to the form (assemblage of slopes) and pattern of forms expressed by a surficial material at the land surface. This three-dimensional shape of the material is equivalent to "landform" used in a non–genetic sense (e.g., ridges, plain). Surface expression symbols also describe the manner in which unconsolidated surficial materials relate to the underlying substrate (e.g., veneer). Surface expression is indicated by up to three lower case letters, placed immediately following the surficial material designator, listed in order of decreasing extent.

Label	Name	Description
a	apron	Material that has been transported down a slope and deposited in accumulations at the base of the slope.
b	blanket	A layer of unconsolidated material thick enough to mask minor irregularities of the surface of the underlying material, but still conforms to the general underlying topography. A blanket is greater than 1 m thick and possesses no constructional forms typical of the material's genesis; outcrops of the underlying unit are rare.
d	delta	Flat to gently sloping surface deposited at the mouth of a river in a body of water. Channel scars on the delta surface are commonly visible.
f	fan(s)	A fan is a relatively smooth sector of a cone with a slope gradient from apex to toe up to and including 15° (26%), and a longtitudinal profile that is either straight, or slightly concave or convex. Commonly applies to fluvial fans.
h	hummocky	Steep-sided hillock(s) and hollow(s) with multidirectional slopes dominantly between 15 and 35° (26 to 70%) if composed of unconsolidated materials; bedrock slopes may be steeper. Local relief is greater than 1 m. In plan, an assemblage of non-linear, generally chaotic forms that are rounded or irregular in cross-profile. Commonly applied to knob-and-kettle glaciofluvial terrain.
m	rolling	Elongate hillock(s) with slopes dominantly between 3 and 15° (5 to 26%) with local relief greater than 1 m. In plan, an assemblage of parallel or sub-parallel linear forms with subdued relief. Commonly applied to bedrock ridges and fluted or streamlined till plains.
p	plain	A level or very gently sloping, unidirectional (planar) surface with gradients 0 to 3° (0 to 5%); local surface irregularities generally have a relief of less than 1 m. Applied to (glacio)fluvial floodplains, organic deposits, lacustrine deposits and till plains.
r	ridge(s)	Elongate hillock(s) with slopes dominantly between 15 and 35° (26 to 70%) if composed of unconsolidated materials; bedrock slopes may be steeper. Local relief is greater than 1 m. In plan, an assemblage of parallel or sub–parallel linear forms. Commonly applied to drumlinized till plains, eskers, morainal ridges, crevasse fillings and ridged bedrock.
s	steep slope	A unidirectional (planar) surface with gradients greater than 35° (70%), and a smooth longitudinal profile that is either straight, or slightly concave or convex; local surface irregularities generally have a relief of less than 1 m; bedrock slopes may be more irregular. Commonly applied to terrace scarps, gully side walls and bedrock cliffs.
t	terrace(s)	A single or assemblage of step-like forms where each step-like form consists of a scarp face and a horizontal or gently inclined surface (tread) above it. Applied to fluvial and lacustrine terraces and stepped bedrock topography.
v	veneer	A layer of unconsolidated materials too thin to mask the minor irregularities of the surface of the underlying material. It is between about 10 cm and 1m in thickness, and possesses no constructional form typical of the material genesis. Commonly applied to eolian loess and colluvial veneers.
x	complex	A combination of several surface expressions.

GEOMORPHOLOGICAL PROCESSES

Geomorphological processes are natural mechanisms of weathering, erosion and deposition that result in the modification of the surficial materials and landforms at the earth's surface. Process is indicated by up to three upper case letters, listed in order of decreasing importance, placed after the surface expression symbol, and separated from the surface expression by a dash (-).

Group	Process	Label	Description
Erosional Processes	deflation	D	The removal of sand and silt sized particles from unconsolidated materials by wind.
	thermokarst	K	Characterized by subsidence and caving due to melting or ground ice in permafrost areas.
	gully erosion	V	Running water, mass movement and/or snow avalanching, resulting in the formation of parallel and subparallel long, narrow ravines.
	washing	W	Wave action or, locally, running water (e.g., meltwater), resulting in lag deposits formed by the removal of fines from a mixture of coarse and fine particles.
	bevelled	B	Cut or planed by running water but not underlain by fluvial deposits.
Mass Movement Processes	snow avalanches	A	Rapid downslope movement of snow and ice, as well as incorporated rock, surficial material and vegetation debris, by flowing or sliding.
	failing	F	Downslope movement of masses of cohesive or non-cohesive surficial material and/or bedrock by creeping, flowing or sliding.
Periglacial Processes	cryoturbation	C	Movement of surficial materials by heaving and/or churning due to frost action (repeated freezing and thawing).
	nivation	N	Erosion of bedrock or surficial materials beneath and along the margin of snow patches by freeze/thaw processes (frost shattering and heave), meltwater action and snow creep.
	solifluction	S	Slow gravitational downslope movement of saturated non-frozen overburden across a frozen or otherwise impermeable substrate.
	permafrost processes	X	Processes controlled by the presence of permafrost, and permafrost aggradation or degradation. Applied to areas with ice-wedge polygons, thermokarst features, palsas and pingos.
Deglacial Processes	channeled by meltwater	E	Erosion and channel formation by meltwater alongside, beneath, or in front of a glacier.
	kettled	H	Depressions in surficial materials resulting from the melting of buried glacier ice.

TEXTURE

Describes the dominant size of particles in mineral sediments and the fiber content of organic materials. Texure is indicated by up to three lower case letters.

Label	Name	Description
a	blocky	Angular particles greater than 256 mm in size.
r	rubbly	Angular particles with a size range of 2-256 mm, but may include interstial sand.
g	gravelly	Two or more size ranges of rounded particles greater than 2 mm, but may include interstial sand.
f	fine	A mixture of silt and clay; may also contain a minor fraction of fine sand.
b	bouldery	Rounded particles greater than 256 mm in size.
k	cobbly	Rounded particles having a diameter of 64-256 mm.
p	pebbly	Rounded particles having a diameter of 2-64 mm.
s	sandy	Particles of which the fine fraction contains more than 70% by weight of fine sand or coarse particles. Particles great than 2 mm occupy less than 35% by volume.
z	silty	Particles of which the fine earth fraction contains less than 15% of fine sand or coarse particles and has less than 35% clay. Particles greater than 2 mm occupy less than 35% by volume.
c	clayey	Particles where the fine earth fraction contains 35% or more clay (less than 0.002 mm) by weight and particles greater than 2 mm occupy less than 35% by volume.
f	fibric	The least decomposed of all organic materials; there is alarge amount of well preserved fiber that is readily identifiable as to botanical origin. Fibers retain their character upon rubbing.
m	mesic	Organic material in an intermediate stage of decomposition; there is an intermediate amount of fiber that can be identifiable as to botanical origin.
h	humic	Highly decomposed organic material; there is a small amount of fiber that can be identified as to botanical origin. Fibers that are present can be easily destroyed by rubbing.
w	woody	Organic material containing more than 50% of woody fibers.

SYMBOLS

- glacially aligned landform; includes: drumlins, crag and tails, roches moutonees, flutings, grooves and striae. These landforms indicate past ice flow direction.
- esker; known direction
- esker; unknown direction
- moraine ridge
- glacial meltwater channel - minor
- glacial meltwater channel - major
- glacial lake strand lines
- cirque
- escarpment
- escarpment - failing
- landslide
- recessional glacial limit
- ● Bond site locations
- roads

GEOLOGICAL BOUNDARIES

- defined
- approximate
- assumed

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Original mapping and drafting completed by S. Morison, K. McKenna and S. Davies (1982). Subsequent mapping and compilation completed by J.D. Bond (2003-2004).

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

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105E/04	105E/03	105E/02
105D/13	105D/14	105D/15
105D/12	105D/11	105D/10

Yukon Geological Survey
Energy, Mines and Resources
Government of Yukon

Geoscience Map 2005-8
Surficial Geology of Upper Laberge (NTS 105D/14), Yukon (1:50 000 scale)

by
J.D. Bond, S.R. Morison and K. McKenna