GEOLOGICAL SURVEY OF CANADA — COMMISSION GÉOLOGIQUE DU CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES
MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES

EXPLANATION OF LANDFORM UNIT NOTATIONS

Compositional-Genetic Category — Age Modifier — Process or Form Modifier — Morphologic Modifier(s) — Textural Modifier

$^{2}_{A}$ Stratigraphic relationships given where thickness of upper unit is irregular and where underlying unit is a known compositional-genetic unit other than bedrock.

Compositional-Genetic Categories[1]

A- Alluvial Deposits: sand and gravel with veneer of fine sediment and organics; mainly Pleistocene; floodplain (Ap) modern.

C- Colluvial Deposits: various materials, mainly rubble, includes landslides ($^{C}_{L}$); undifferentiated age.

D- Drift: undifferentiated till, sand, and gravel.

E- Eolian Deposits: fine sand and silt; pre-Wisconsinan (pre-Reid).

G- Glaciofluvial Deposits: sand and gravel with veneer of fine sediment.

L- Lacustrine Deposits: mainly silt and clay with little fine sand; Late Wisconsin (McConnell).

M- Morainal Deposits: till, silty/sandy diamicton; rock glaciers (MR), rubble; modern.

R- Bedrock: various types; pre-Pleistocene.

Age Modifiers[2]

1- Late Wisconsin (McConnell)

2- Early Wisconsin or Illinoian (Reid)

2a- Early Wisconsin or Illinoian (Laurentide Glaciation)

3- Illinoian or pre-Illinoian (pre-Reid)

Textural Modifiers

a- sand or gravel

b- boulders, blocks, bouldery

f- fine sand, silt and clay; commonly with high organic content

g- gravel, gravelly

r- rubble, predominantly sand to boulder-sized fragments

Morphologic Modifiers

a- apron

b- blanket[3]

f- fan

h- hummocky

m- undulating, rolling

n- nondescript slope, bedrock controlled

p- plain, floodplain

r- ridge, ridged

s- steep slope (greater than 35°); cliff

t- terrace, terraced

v- veneer[4]

1- gentle to moderate slope (1-15°)

2- moderate to steep slope (15-35°)

Process or Form Modifiers

A- active deposition

$^{T}_{K}$ - thermokarst, modified by thermokarst

R- rilled

[1] General descriptions of texture and age are given for each category; only where texture and age differ from the general description are textural and age modifiers used.

[2] The age modifier is used only where the deposit can be definitely ascribed to a single age, except for Ap which is modern.

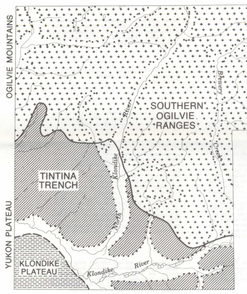
[3] Blanket indicates category forms nearly continuous cover greater than 1 m thick, generally 0.5 to 3 m thick, over a unit, commonly rock.

[4] Veneer indicates category forms broken thin cover, generally less than 1 m thick, but averaging 0.3 m thick, over a unit, commonly rock.

Geological boundary (defined, approximate, assumed)
Fault scarp, postglacial
Fluted bedrock
Fluted till
Morainic ridge (age as given by modifier)
Meltwater channel (age as given by modifier)
Nivation terrace
Pingo
Thermokarst depression
Landslide scar
Stream-trimmed scarp (unconsolidated material, bedrock in part)
Stream-cut ravines and canyons (unconsolidated material, bedrock in part)
Limit of mapping

Note: Not all units and symbols shown in the legend necessarily appear on this map.

PHYSIOGRAPHY



VALLEY or BASIN (DEPRESSION) - Low-lying land bordered by higher ground; flat, smooth, or gently undulating terrain with few surface irregularities.

PLATEAU - Land standing well above valleys but below elevation of nearby mountains; flat, smooth, gently sloping to moderately hilly terrain in places dissected by valleys, but major part of surface in near summit level.

HILLS - Prominences that rise above surrounding terrain; relief less than 350 m; rounded summits.

MOUNTAINS - Prominences that rise above surrounding terrain; relief more than 350 m; have restrictive summit area and steep slopes.

BOUNDARIES

Between physiographic systems.
Between major physiographic subdivisions.
Delineating minor physiographic subdivisions.

INDEX MAP

MAP 6-1982

SURFICIAL GEOLOGY AND GEOMORPHOLOGY

NORTH KLONDIKE RIVER

YUKON TERRITORY

Scale 1:100 000

Kilometres 2 0 2 4 6 8 Kilometres

Miles 2 0 2 4 Miles

Universal Transverse Mercator Projection

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DESCRIPTIVE NOTES

The Yukon Plateau is represented within the map area by Klondike Plateau and Tintina Trench.[1]

Klondike Plateau is a gently rolling surface, which is deeply incised by streams, many of which are gold bearing. The highest point of the plateau in the map area is Mount Leotta (960 m elevation). Streams flow in narrow, steep-sided, V-shaped valleys up to 200 m deep. The edge of the Plateau is marked by the steep slopes of the Ogilvie Mountains on the north side of Klondike Valley and by an escarpment by the Nasina "Series"[2] comprising low-grade metamorphosed sedimentary rocks, mainly micaceous quartzites, schists, and gneisses of uncertain age,[3] in places these rocks are overlain by Tertiary volcanics and sediments.[4]

The floor of Tintina Trench is a rolling plain sloping generally southward from 1000 m at the foot of the Ogilvie Mountains to 800 m at the foot of the Nasina Series south of the Klondike. Much of the floor is covered by a veneer of alluvial fan, Klondike River and its tributaries are incised into the surface in broad, flat-floored valleys up to 90 m deep. The drainage pattern is subparallel with rivers flowing from the sides of the Trench into Klondike River, which flows westward to the Yukon. The floor of the Trench consists of Paleozoic carbonates, cherts, and cherty and argillite which outcrop in the easternmost part of the Trench.[5] The Tertiary rocks consist of arkosic and micaceous sandstones which outcrop to the west of North Klondike River (near the power house) chain and conglomerate which outcrop in the high bluffs east of North Klondike River (along the ditch) and south of the Klondike River (Rock Island). The Tertiary rocks are mainly (Miocene?) and well stratified, well sorted, sparsely fine to medium sand and silt overlain by gravel, known as the Flat Creek Beds,[6] which outcrop in the scarps of the meso-like area bounded by Klondike River and Flat Creek. On the basis of many plant fossil identifications, an Eocene age has been ascribed to the Ethnigrien Beds by Hughes et al.[7] and Hughes[8] but Miocene palynomorphs from the Flat Creek Deformation in Tintina Trench was probably continuous throughout the late Cretaceous and Tertiary; rocks may be present from throughout this time.[9]

The Southern Ogilvie Ranges[1] of the Ogilvie Mountains rise to 2193 m at Tombstone Mountain, with average relief being over 1000 m. Slopes are steep and mountain crests are sharp and jagged, particularly the Tombstone Range where the towering pinnacles are the result of well developed vertical joints in igneous rocks. Glacial ice flowed from the Ogilvie Mountains into the Klondike Valley, Klondike River, Brewery Creek, and Chandindu River. The valleys are steep sided with side, flat floors and U-shaped profiles typical of glaciated valleys. The Ogilvie Mountains are part of the Klondike Schist, which is composed of quartzites, dioritics, gabbros, and syenites, surrounded by Precambrian to Silurian quartzites, slates, volcanics, cherts, and argillites;[7] they have been thrust faulted and folded into their present positions during the Columbian Orogeny (Cretaceous).[8] Fault activity along Tintina Trench is still active as shown by postglacial movement on a fault near the mouth of North Klondike Valley.

The map area lies within the zone of widespread discontinuous permafrost,[10] permafrost is absent on south facing slopes, but is continuous on north facing slopes with talus accumulations, large areas of lakes and bottomless moss south-facing slopes. Ground ice occurs as ice-wedge polygons in moderately to poorly drained, fine grained sediments; small ice wedges and ice lenses in peat; several metres of massive ice in some low-lying areas, particularly at the bases of slopes; nonvisible, interstitial ice is probably widespread in the silty sediments.

The pediment that occurs throughout the unglaciated parts of the Yukon, here slopes from the Ogilvie Mountain down to Klondike River; remnants of this surface occur in the Klondike Plateau as smooth, gently sloping areas above the highest Boreal terraces. The pediment is probably of late Tertiary age as it is cut by Pleistocene drift and is graded to Pliocene terraces. The oldest Pleistocene drift north of this map area in Tatlo Valley. The pediment was probably formed penecontemporaneously with the deposition of the White Channel Gravels,[6] which underlie the highest terraces along Hunker Creek and other creeks west of the map area. The exact age of the White Channel Gravels is unknown, but they have been ascribed to the Pliocene.[7]

Prior to any glaciation, Klondike river flowed southeast to Stewart River with a drainage divide just east of the mouth of Hunker Creek.[11] The earliest glaciation of the area was a valley glacier that flowed southward down the ancestral Klondike River to its present configuration. The Flat Creek Beds have been interpreted as glaciofluvial gravels overlying glaciolacustrine silts and sands, which were deposited during this glacial event,[7] but it appears more likely that these aeolian silts and sands are Tertiary and relate to the aeolian White Channel Gravels, and that the Flat Creek Beds gravels are the first glaciofluvial deposits to this glacial event. The top of the Flat Creek Beds appears to be aligned with the top of the Klondike Gravels,[12,13] which occur on terraces overlying or in places cutting through the White Channel Gravels and are considered to be the White Channel Gravels. Moreover, both the Flat Creek Beds and Klondike gravels contain clasts derived from the Ogilvie Mountains (unlike the underlying strata). On the basis of this, deposition of the Flat Creek Beds gravels and Klondike Gravels is correlated with the earliest Pleistocene glaciation. An ash overlying the Klondike Gravels is dated at 1.2 Ma.[14]

The extent of the earliest glaciation is unknown. Klondike Plateau was probably glaciated at least once, but no evidence of glaciation has been found in one or more of the early glaciations. The only evidence of the earliest glaciation is an exposure of till in a borrow pit at the intersection of the old and new Klondike Highways. At this location the sequence from top to bottom is: 2 m well stratified, well rounded gravel and sand; 7 m silty diamicton; 11 m well stratified sandy, pebbly gravel; 2 m medium to coarse sand. The upper gravel is interpreted as pre-Reid outwash and therefore the diamicton must be a pre-Reid till. The underlying gravel and sand may be outwash from this or an earlier glaciation. The diamicton is the only till found south of Klondike River. The extensive mass wasting (solifluction) on the Klondike Plateau has made the tracing of units difficult. High-level gravel terraces, which are probably correlative with the outwash overlying the Flat Creek Beds, exist along the north side of Klondike valley to the east of the North Klondike.

A truncated Luvisol, indicative of a warm, subhumic climate with grassland-shrub vegetation, has developed at the top of the upper pre-Reid gravels in the Flat Creek Beds.[15] This was succeeded by a cold, dry period during which fine sand, which fract cracks developed in the soil. Eolian activity filled these fract cracks with sand, produced ventifacts on the surface, and in places deposited a veneer of loess during the McConnell Glaciation.[16] Orthic Sombric Brunisol (Brunisol Illuvial)[17] developed during postglacial time.

Downcutting of Klondike River and its tributaries occurred since the earliest (Nansen?) glaciation and continued through the Reid Glaciation. Reid and McConnell glaciations caused fluctuations in the regime of Klondike River which resulted in the formation of two major river terraces. Several terrace levels also developed along tributary creeks on some creeks, particularly along Hunker and Dominion creeks, these terraces have been extensively mined for placer gold during mining operations. The bones are 22 000 to 32 000 radiocarbon years old[18] and are indicative of a grassland environment. The downcutting of Klondike River and Flat Creek probably caused the massive, deep-seated, retrogressive landslides along adjacent scarps in the Flat Creek Beds and the smaller slumps on the north side of Klondike Plateau.

The last two glaciations in this area are well recorded by their deposits and associated landforms. Ice from the Ogilvie Mountains flowed down valleys to meet along the interfluves, down tributary valleys, and, in places, coalesced in the main valley to form trunk glaciers. Cirque ages are already published.[19,20]

During the older glaciation - Reid Glaciation - glaciers from the Tombstone Range and from tributary valleys flowed westward down Tombstone, Little Twelve Mile, and Chandindu river valleys to near the mouth of Alder Creek (west of the map area) and eastward down North Klondike valley to about the ditch near Ogilvie River. Ice from Tombstone Range also flowed down the valley of Klondike River by the extensive area of rounded ridges and steep-sided, flat-floored meltwater channels that parallel the moraines. The glacial limit on the east side of North Klondike River is less distinct and is marked primarily by the break in slope between the pediment and North Klondike valley. The limit is most clear on the south side of Klondike Valley where it is marked by a prominent morainic crest exist along part of this limit. Outwash was deposited into Tintina Trench and may have pushed Klondike River against the south side of its valley; no evidence of this outwash remains south of Klondike River, presumably because it has been nearly covered by younger sediments. A similar sequence of events must have occurred in Brewery Creek valley; the limit of Reid Glaciation along the valley sides is marked in a few places by small deposits of till. The Reid glacier in Andimary Creek valley did not join the main glacier in North Klondike valley but formed a lobe downhill and was down the valley.

McConnell Glaciation was not as extensive as Reid Glaciation, and glaciers generally did not reach the valley bottoms. Ice from the Ogilvie Mountains formed glaciers. Moreover, not all cirques that nourished the Reid glaciers were active during McConnell Glaciation.[19] Glaciers from the Tombstone Range flowed down Tombstone and Little Twelve Mile valleys but did not reach Tintina Trench. Chandindu valley glaciers also flowed eastward from the Tombstone Range down North Klondike valley but built a moraine where the river turns south just to the north of this map area. Ice flowed down Brewery Creek valley to its first major tributary from the west but was not joined by the glacier in this tributary, which built a moraine where the river turns south just to the north of this map area. Ice deposited outwash in front of the into this outwash is preserved as a low terrace inset into the higher terrace of Reid age along the present rivers. During all of the glacial periods, eolian activity deposited loess over much of the area, particularly on outwash deposits and on the pediment in Tintina Trench.

Periglacial and other subaerial mass wasting processes, both during glacial and nonglacial times, have constantly been altering the land surface, in places producing thick accumulations of colluvium. Most notable are the landslides, which occur along the scarps of the Ogilvie Mountains. Many of these landslides probably were caused by overcreepening of the valley walls during Reid Glaciation. Rock glaciers have formed in these landslide deposits and are presently active; other rock glaciers are active in cirques of former glaciers. Streams flowing from tributary valleys have formed alluvial fans along the sides of the main valley. Well developed fans are present along Hunker Creek, Flat Creek, and Brewery valleys presumably relate to different glacial and nonglacial events.

Hazards to development include flooding of the major streams during spring thaw and after heavy rainfalls, rock glaciers, landslides, and the postglacially active fault. These subsidence may be severe following development or disturbance in areas of low-lying, poorly drained, fine grained materials. The best sources of granular material are the glaciofluvial and alluvial terrace deposits, including those in Klondike River and Tintina Trench, alluvial fan and apron deposits and some morainal deposits may be usable after treatment.

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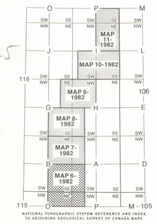

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NORTH KLONDIKE RIVER
YUKON TERRITORY

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