Natural Resources Canada / Ressources naturelles Canada

STRATIGRAPHIC SECTIONS

1

Unit	Description
L	Clayey silt with scattered pebbles. They are mostly disaggregated sandstone and mudstone, and decrease in quantity toward top of unit. Calcium carbonate veining is extensive within the sediments
TC	Diamicton. Cohesive fine sandy loam matrix. Moderately stony, clasts from granules to cobbles up to 10 cm in size. Contains coal, disaggregated sandstones, coal, siltstones, and resistant lithologies including Shield pebbles. Medium brown
L	Stoneless medium sand with a 10 cm band of fine sand and a 2 cm band of medium-coarse sand at the unit base. The uppermost part of the unit has very faint diagonal stratification. Lower contact is abrupt. Upper contact is fairly abrupt and undulating, with evidence of a 3 mm wide injection plume of sand into overlying unit, and faint bedding distortion in the sand
TC	Very stony diamicton (till). Matrix ranges from friable silty sand near the base to more cohesive silty matrix containing some clay near the top. Has small blocky ped structure. Clasts are rounded to subangular granules to boulders larger than 40 cm; some have flat-iron-like tops and basal keels. Contains Shield pebbles. Diamicton ranges from medium brown to dark grey brown. Two fabrics taken within this diamicton indicate flow from the east
TC	Gradational sheared zone between bedrock and overlying diamicton. The number of local angular grey mudstone bedrock clasts within the diamicton decreases upward through this unit, whereas diamicton content increases
R	Sandstone and shale. Extends 20 m to base of slope

2

Unit	Description
TC	Diamicton (till). Contains Shield stones. Heavily slumped
L	Clay and pebbly clay. Contact with gravels is gradational. Unit becomes increasingly clayey and less stony toward top. Clay beds within unit are 1-2 cm thick. Top 5 cm is heavy, weakly stratified clay
GM	Weakly stratified pink gravel. Contact with bedrock is abrupt. Bottom 20-30 cm is a fine gravel with some clasts to 7 cm. Remainder of unit is poorly sorted with clasts to 30 cm: matrix ranges from very silty sand to pink clay skins on open work pebble and cobble clasts
R	Bedrock

3

Unit	Description
A	Slightly pebbly silt. Clasts up to 2 cm. Contains two paleosols within 40 cm of the ground surface
TC	Diamicton (till). Slightly stony. Medium yellowish brown (moist). Matrix is a slightly clayey silt. Clasts range up to 10 cm and are subrounded to subangular. Lithologies include limestone, brown quartzite, disaggregated local sandstone, coal, purple banded quartzites, red and green argillites, white quartzites and Shield stones. Contact with overlying unit is abrupt and undulates over more than 2 m
GM	Angular bouldery pink gravel. Very poorly sorted and disorganized; up to 50% clasts with a matrix of fine sandy silt with some clay. Contains very coarse, clasts up to 2 m, and very angular to subangular. Lithologies are of montane provenance, from Purcell Supergroup. Pink colour derived from red argillite. Contact with above unit is not exposed
TM	Gradational zone. Clasts within diamicton become increasingly angular and larger upward
TM	Diamicton (till). Very stony, but not as stony as the gravelly unit below; contains some stonier patches. Matrix is silty with a significant granule and coarse sand content. Pink colour derived from Purcell red argillite. Clasts range from well rounded to subangular; all are derived from the Purcell Supergroup
GM	Poorly sorted pink gravel. Matrix is mostly medium and coarse sand with some fines. Clasts range up to 40 cm and are rounded to subrounded. Contact with overlying unit is marked by a row of large cobbles and boulders
TM	Diamicton (till). Very stony, clasts are mostly subrounded to rounded and range up to 10 cm. Pink colour derived from Purcell red argillite. Lithologies are all of montane provenance, predominantly Purcell Supergroup. No Shield stones noted. Contact with overlying unit is abrupt, but undulates over 0.5 m
C	Covered by colluvium

4

Unit	Description
GC	Poorly sorted pebble and cobble gravel, sandy matrix. All clasts have a thick caliche coating on their bases
GC	Poorly sorted pebble gravel. Clasts range up to about 6-7 cm, averaging 2 cm, with a coarse sand matrix
L	Clay with dropstones and interbeds of sandy gravel. The contact between the underlying diamicton and this unit is abrupt. The bottom 20 cm of the unit is very stony clay. Remaining clay has only scattered clasts. Breaks into angular irregular blocks less than 1 cm in size and has no evident structures or layering. Two 10 cm thick layers of sandy pebble gravel occur in the middle of the unit
TC	Diamicton (till). Clasts to 15 cm in a greyish brown (moist) fine sandy silt and clay matrix. Some stones are striated and faceted. Lithologies include Shield pebbles. Breaks into angular prisms. Fabric indicates flow from the northeast
GM	Pink gravel. Faintly stratified, clast-supported cobble gravel with a coarse sandy matrix. Clasts average 7 cm, some up to 30 cm, and are coated with pink clay skins. Contact with the above unit is a carbonate-cemented layer 1 cm thick of pebbles and fines. Contact is abrupt and slightly undulating
C	Covered by colluvium

Vertical scale (metres): 0 – 5

SUBSURFACE UNITS

Postglacial

- O — Peat
- C — Colluvium
- E — Eolian fine sand and silt
- A — Alluvial sand and gravel
- L — Lacustrine sand, silt, and clay

Wisconsinan -- Erratics Train Glaciation

- LE — Laminated and thinly bedded glaciolacustrine sand, silt, and clay
- GC — Outwash gravel and sand containing clasts from Canadian Shield
- GM — Outwash gravel and sand (Rocky Mountains and Foothills provenance)
- TC — Till and related glaciogenic diamictons containing clasts transported from the Canadian Shield
- TM — Till and related glaciogenic diamictons of Rocky Mountains and Foothills provenance

Pre-Wisconsinan

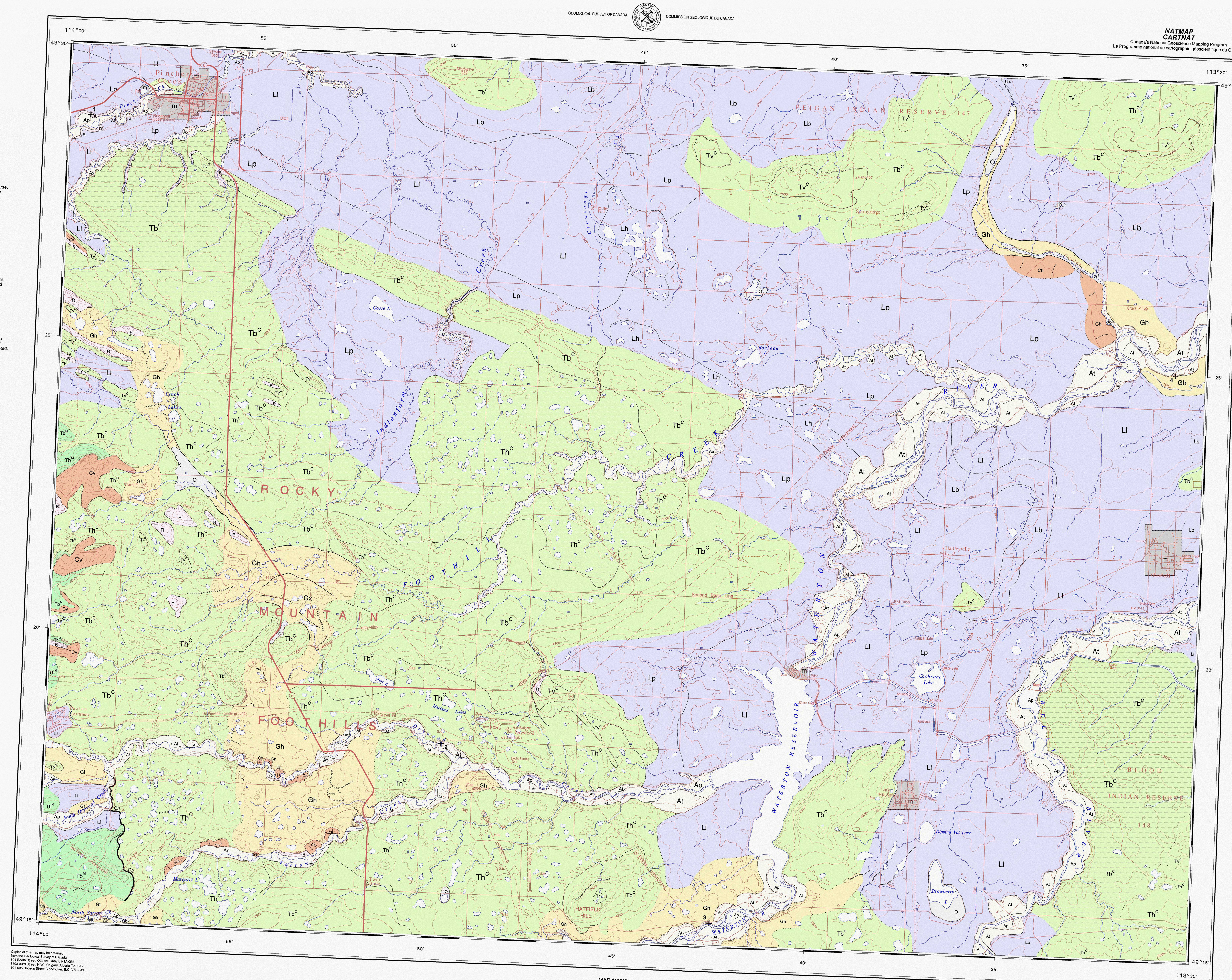
- PW — Rocky Mountains provenance glacial sediments and interstratified paleosols

Preglacial

- R — Sandstone and shale

GEOLOGICAL SURVEY OF CANADA — COMMISSION GÉOLOGIQUE DU CANADA

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



Copies of this map may be obtained from the Geological Survey of Canada:
601 Booth Street, Ottawa, Ontario K1A 0E8
3303-33rd Street, N.W., Calgary, Alberta T2L 2A7
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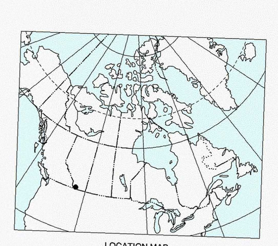

LOCATION MAP

Published 1998

MAP 1933A

SURFICIAL GEOLOGY

PINCHER CREEK

ALBERTA

Scale 1:50 000 - Échelle 1/50 000

Kilometres 1 0 1 2 3 4 Kilomètres

Universal Transverse Mercator Projection
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Geology by E.R. Leboe, 1994 and 1995

Co-ordinated by D. Lebel through the auspices of the Southeastern Cordillera NATMAP Project

Digital cartography by K. Shimamura, Terrain Sciences Division and L.P. Renaud, Geoscience Information Division

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

Digital base map from data compiled by Geomatics Canada, modified by the Geoscience Information Division

Copies of the topographic map for this area may be obtained from the Canada Map Office, Natural Resources Canada, Ottawa, Ontario, K1A 0E9

Some geographical names subject to revision

Magnetic declination 1998, 17°17′E, decreasing 6.2′ annually

Elevations in feet above mean sea level

82 J/10	82 J/9 1925A	82-I/12	82-I/11
82 J/7	82 J/8 1926A	82-I/5	82-I/6
82 J/2	82 J/1 1927A	82-I/4	82-I/3
82 G/15	82 G/16 1928A	82 H/13 1929A	82 H/14
82 G/10	82 G/9 1930A	82 H/12 1931A	82 H/11
82 G/7	82 G/8 1932A	82 H/5 1933A	82 H/6 1934A
82 G/2	82 G/1	82 H/4 1935A	82 H/3 1936A

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

LEGEND

Not all coloured units and symbols in legend necessarily appear on this map
This legend is common to maps 1925A to 1936A

QUATERNARY

HOLOCENE - Post Erratics Train Glaciation

- m — ***MADE LAND:*** *Artificial fill and mine waste*
- I — ***EXISTING GLACIERS, ICE:*** *Flowing or stagnant glacial ice; contains or is covered by variable amounts of rock debris ranging from clay to boulders; thickness of ice 20 - 40 m*
- O — ***ORGANIC SEDIMENTS:*** *Water-saturated* ***Sphagnum*** *peat and organic silt formed predominantly by the accumulation of vegetal material in bogs, fens, and swamps; organic deposits are usually underlain by lacustrine silt and clay; thickness up to 5 m*

EOLIAN SEDIMENTS: *Sand and silt transported by wind*

- Eb — ***Eolian blanket:*** *Sand, well sorted, massive; forms gently undulating plains marked by crescent-shaped dunes; thickness up to 5 m*

COLLUVIAL SEDIMENTS: *Stony diamicton resulting from the mixture of varying amounts of broken bedrock, soil, and glacial sediments by nonfluvial gravitational processes such as creep, solifluction, debris flow, snow avalanching, and rockfall. Reworked glacial sediments in colluvium occur within the limits of past glaciations*

- Cb — ***Colluvial blanket sediments:*** *Diamicton, stony, massive, 1 to 2 m thick*
- Cv — ***Colluvial veneer sediments:*** *Diamicton, stony, massive, <1 m thick or patchy; overlies bedrock*
- Ca — ***Colluvial apron sediments:*** *Bouldery diamicton and poorly sorted and stratified sand and gravel; sediments form a wedge-shaped slope-toe complex of small steep debris flow and avalanche-dominated fans and solifluction deposits derived from bedrock or glacial debris up slope; thickness ranges from <1 m at the up slope limit to up to 10 m in the thickest part of the apron*
- Cc — ***Rockfall sediments:*** *Bouldery rockfall deposits; forms cone-shaped landforms at the angle of repose below steep bedrock slopes; thickness ranges from <1 m at the margin to 10 m near the midpoint of the cone*
- Ch — ***Landslide sediments:*** *Diamicton formed of broken rock, soil, and glacial deposits; forms a hummocky or ridged topography with ridges transverse to direction of movement; thickness variable, may range up to 10 m (direction of movement indicated by symbol)*
- Cx — ***Undivided colluvial sediments:*** *Hummocky apron terrain adjacent to mountainous uplands, possibly of mass wasting origin*

ALLUVIAL SEDIMENTS: *Gravel to silt size sediments deposited by streams either within channels or as overbank deposits. Deposits are commonly stratified and moderately to well sorted, with the exception of some alluvial fan deposits*

- Ap — ***Alluvial plain sediments:*** *Gravel and sand, massive to stratified, moderately to well sorted; locally overlain by or includes lacustrine silt and clay and minor peat and organic silt deposited in abandoned channels and along floodplain margins; forms plains within about 1 m of present stream level which are subject to inundation during floods; thickness 1 to 5 m*
- At — ***Alluvial terrace sediments:*** *Gravel and sand, massive to stratified, moderately to well sorted; sediments are of floodplain origin now isolated from flooding by stream incision; thickness ranges from a discontinuous covering on bedrock to several metres; where alluvial terraces are cut into glaciofluvial plains, total thicknesses of gravel and sand may be 5 m or more*
- Af — ***Alluvial fan sediments:*** *Gravel and gravelly diamicton, stratified, poorly to moderately sorted; forms fan-shaped landforms where streams enter larger valleys; in mountainous terrain, alluvial fans may be subject to inundation of debris flows; thickness up to 10 m*
- Ax — ***Alluvial complex sediments:*** *Floodplains, fans, and terraces that cannot be subdivided at the scale of mapping*

WISCONSINAN - Erratics Train Glaciation
Sediments deposited during advances and retreats of glaciers from Rocky Mountains and continental interior

GLACIOLACUSTRINE DEPOSITS: *Well stratified sand, silt, and clay deposited in lakes dammed by glacial ice. Where deposition was distant from ice margins, glaciolacustrine sediments underlie plains or gently rolling terrain. Where deposition was near ice, they may underlie ridged, hummocky, or pitted terrain caused by subsequent ice meltout. May include some postglacial lacustrine sediments*

- Lv — ***Glaciolacustrine veneer sediments:*** *Silt, clay, and fine sand, well stratified, thinly bedded to laminated or discontinuous; thickness <1 m thick to discontinuous*
- Lb — ***Glaciolacustrine blanket sediments:*** *Silt, clay, and fine sand; surface morphology conforms to underlying topography*
- Ll — ***Glaciolacustrine plain sediments, local relief <1 m:*** *Silt, clay, and fine sand, thinly bedded to laminated; surface morphology is a plain and underlying topography is generally obscured by these sediments; thickness 1 to 20 m*
- Lp — ***Rolling glaciolacustrine plain sediments, local relief 1-2 m:*** *Fine sand, silt, and clay, thinly to massively bedded; surface morphology undulating; underlying topography is generally obscured by these sediments; thickness 1 to 20 m*
- Lh — ***Ice-contact glaciolacustrine complex sediments:*** *Predominantly silt and sand; gravel, diamicton lenses and dropstones may comprise up to 10% or more of this unit; bedding thin to massive; bedding is commonly deformed due to syndepositional slumping and ice meltout; surface morphology is hummocky, pitted, and ridged with relief up to 10 m; commonly underlain by hummocky moraine sediments; thickness 5 to 10 m*

GLACIOFLUVIAL SEDIMENTS: *Sand, gravel, and minor silt and diamicton deposited by streams flowing away from, or in contact with glacial ice. Sorting ranges from good to poor and stratification from thinly bedded to massive. Sediments may display evidence of syndepositional collapse due to meltout of buried or supporting ice. In areas formerly covered by glaciers from the Rocky Mountains only, lithologies include Precambrian and Paleozoic limestone, dolostone, argillite, and quartzite, and may include mafic and felsic volcanic rocks in the Oldman River basin. In areas covered by montane glaciers and glacier ice from the continental interior, additional lithologies include sandstone, mudstone, conglomerate and Canadian Shield provenance granitic and metamorphic lithologies*

- Gp — ***Glaciofluvial plain and fan sediments:*** *Gravel and sand; massive to thickly bedded; former outwash plains and fans; thickness 1 to 10 m*
- Gt — ***Terraced glaciofluvial sediments:*** *Gravel and sand; massive to thick bedded; former outwash plains and fans incised into a succession of terraces; thickness 1 to 10 m*
- Gd — ***Glaciofluvial delta sediments:*** *Sand, gravel, and minor silt and clay; thinly bedded to massive; flat surfaced, delta-form in plan view; deposited as a delta along the margin of a former glacial lake; thickness from 5 to 10 m*
- Gh — ***Glaciofluvial ice stagnation complex sediments:*** *Sand, gravel, diamicton, and minor silt and clay, thinly bedded to massive; bedding is commonly contorted and folded due to syndepositional ice meltout; surface morphology includes hummocks, kettle, esker and crevasse-fill ridges 2 to 10 m in relief with minor elements of unit Gp and Gt; thickness 5 to 10 m*
- Gx — ***Undivided glaciofluvial and ground moraine sediments:*** *A patchwork of glaciofluvial sediments and ground moraine (till) too variable to resolve at the scale of mapping*
- Gv — ***Glaciofluvial veneer sediments:*** *Gravel and sand, massive to thickly bedded; thickness <1 m or patchy; overlies bedrock*

MORAINAL SEDIMENTS (till): *Diamicton (pebble to boulder size clasts suspended in a poorly sorted clay to sand size matrix) deposited directly by glacial ice; redeposition, where it has occurred, has been by sediment gravity flow and/or ductile deformation. Tills of two provenances were deposited during the Erratics Train Glaciation: T^C contains clasts of Rocky Front and Main ranges Precambrian and Paleozoic limestone, dolostone, and quartzite; Foothills and Interior Plains Mesozoic and lower Tertiary sandstone, mudstone, and coal; as well as Canadian Shield provenance granitic and metamorphic rocks. T^M contains Rocky Mountain Precambrian and Paleozoic limestone, dolostone, argillite, and quartzite (may include Precambrian igneous rocks south of Crowsnest River); and Foothills Mesozoic and lower Tertiary sandstone, shale, and coal (includes lower Cretaceous volcanics in the Crowsnest Pass area). Trace amounts of Canadian Shield provenance clasts are present only where montane ice overran pre-existing drift containing Canadian Shield provenance clasts*

- Tv^C Tv^M — ***Till veneer:*** *<1 m thick or discontinuous diamicton with patches of exposed bedrock or colluvium. Tv^M generally contains more and coarser pebble and larger clasts than does Tv^C and both may contain extensive areas of thin (<1 m) and patchy colluvium; overlies bedrock*
- Tb^C Tb^M — ***Till blanket:*** *1 to 5 m of diamicton that conforms to the underlying bedrock topography. Tb^M generally contains more and coarser pebble and larger clasts than does Tb^C*
- Th^C Th^M — ***Hummocky moraine:*** *Diamicton and interstratified glaciofluvial gravel and sand, massive to thick bedded; bedding slumped, faulted, and folded by syndepositional ice meltout; may contain variable amounts of ice-walled lake fine sand and silt; forms hummocky, kame and kettle topography; local relief up to 30 m; thickness may be tens of metres*
- Tm^C Tm^M — ***Rolling till plain:*** *More than 5 m of diamicton; surface morphology undulates with 1-2 m local relief; totally or largely obscure surface morphology of underlying bedrock*

EARLY PLEISTOCENE OR PLIOCENE GLACIAL OR NONGLACIAL SEDIMENTS

- Tb^U — ***Till? blanket:*** *Stony diamicton cemented to a calcrete; contains striated clasts; thickness 2 to 3 m; rests on a succession of similar sediments of glacial or nonglacial origin*

PALEOZOIC TO EARLY TERTIARY ROCK

- R — Sandstone, siltstone, shale, mudstone, conglomerate, coal, and minor volcanic rocks of early Tertiary and Mesozoic age and limestone, dolostone, and quartzite of Paleozoic and Precambrian age (includes areas of thin colluvial cover, blockfields, sorted stone polygons in alpine areas)
- R-A — Areas of rock as above subject to rapid mass wasting processes (rockfall and snow avalanches)
- R-G — Upper Mesozoic and Early Tertiary rock eroded into badland topography

VENEER

- Glaciolacustrine
- Eolian
- Organic

Geological boundary (defined, assumed, inferred)
Neoglacial lateral or end moraine
Arête
Cirque
Meltwater channel;
large
small (flow direction known, unknown)
edge of ice-walled channel
Esker (flow direction defined, undefined)
Landform streamlined by glacial ice (direction of flow known, unknown)
Ice limit (defined, assumed, inferred); M1, M2, C1, C2
M1 Maximum ice limit of Late Wisconsinan montane glacial ice
M2 Ice limit of first major readvance of Late Wisconsinan montane glacial ice
C1 Maximum ice limit of Late Wisconsinan continental glacial ice
C2 Readvance position of Late Wisconsinan continental glacial ice
Lateral and end moraine (associated with advance M1, M2, or retreat of continental ice sheet from limit C2)
Former ice contact face in stratified drift
Stratigraphic section
Vertebrate fossil locality
Radiocarbon age (years before present) — 10600±100 GSC 2162
One or more Foothills Erratics Train Erratic >1 m in length
Cosmogenic ^{36}Cl exposure age on Foothills erratic (years before present)* — 15000±400
Montane erratic close to or at the all time upper limit of montane glaciation
Canadian Shield erratic at or near the all time upper limit of continental glaciation
Cosmogenic ^{36}Cl exposure age of Canadian Shield erratic at or near the all time upper limit of continental glaciation (years before present)* — 22500±1200
Arrows indicating direction of landslide movement (associated with the unit Ch)

* Assumes a zero erosion rate and no cosmic ray blockage by snow cover

Recommended citation:
Leboe, E.R.
1998: Surficial geology, Pincher Creek, Alberta;
Geological Survey of Canada, Map 1933A, scale 1:50 000

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