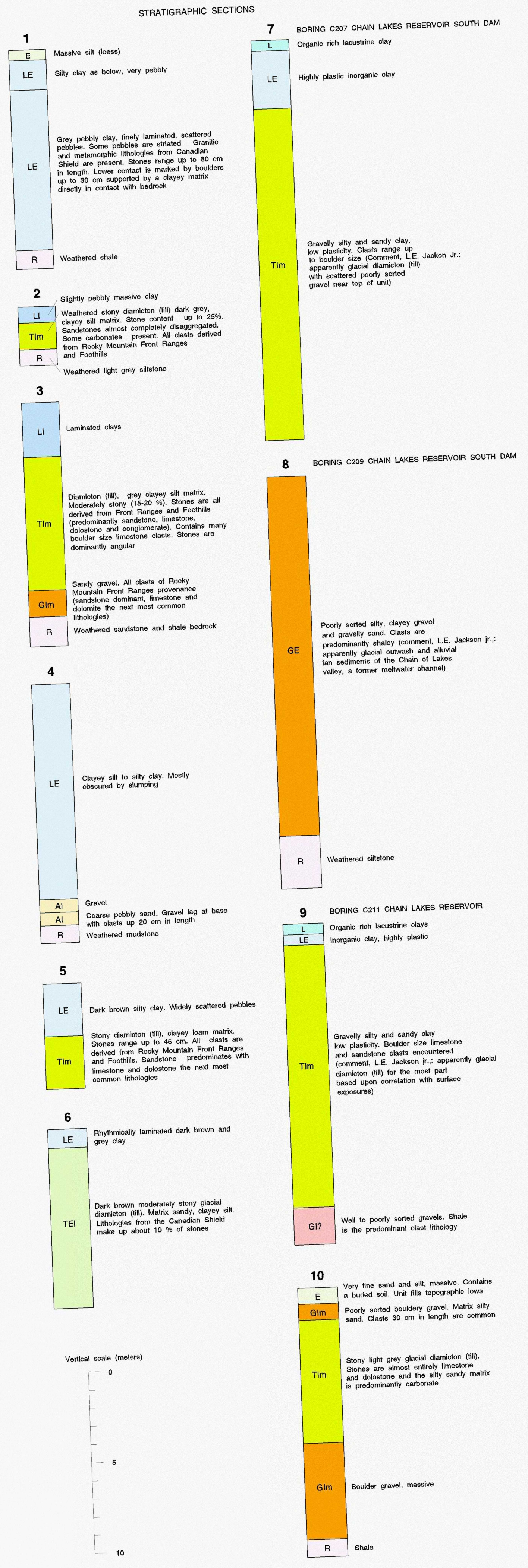
Natural Resources Canada Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA COMMISSION GÉOLOGIQUE DU CANADA

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

STRATIGRAPHIC SECTIONS



1
E Massive silt (loess)
LE Silty clay as below, very pebbly
LE Grey pebbly clay, finely laminated, scattered pebbles. Some pebbles are striated. Granitic and metamorphic lithologies from Canadian Shield are present. Stones range up to 80 cm in length. Lower contact is marked by boulders up to 80 cm supported by a clayey matrix directly in contact with bedrock
R Weathered shale

2
LI Slightly pebbly massive clay
Tlm Weathered stony diamicton (till) dark grey, clayey silt matrix. Stone content up to 25%. Sandstones almost completely disaggregated. Some carbonates present. All clasts derived from Rocky Mountain Front Ranges and Foothills
R Weathered light grey siltstone

3
LI Laminated clays
Tlm Diamicton (till), grey clayey silt matrix. Moderately stony (15-20 %). Stones are all derived from Front Ranges and Foothills (predominantly sandstone, limestone, dolostone and conglomerate). Contains many boulder size limestone clasts. Stones are dominantly angular
Glm Sandy gravel. All clasts of Rocky Mountain Front Ranges provenance (sandstone dominant, limestone and dolomite the next most common lithologies)
R Weathered sandstone and shale bedrock

4
LE Clayey silt to silty clay. Mostly obscured by slumping
Al Gravel
Al Coarse pebbly sand. Gravel lag at base with clasts up 20 cm in length
R Weathered mudstone

5
LE Dark brown silty clay. Widely scattered pebbles
Tlm Stony diamicton (till), clayey loam matrix. Stones range up to 45 cm. All clasts are derived from Rocky Mountain Front Ranges and Foothills. Sandstone predominates with limestone and dolostone the next most common lithologies

6
LE Rhythmically laminated dark brown and grey clay
TEl Dark brown moderately stony glacial diamicton (till). Matrix sandy, clayey silt. Lithologies from the Canadian Shield make up about 10 % of stones

7 BORING C207 CHAIN LAKES RESERVOIR SOUTH DAM
L Organic rich lacustrine clay
LE Highly plastic inorganic clay
Tlm Gravelly silty and sandy clay, low plasticity. Clasts range up to boulder size (Comment, L.E. Jackon Jr.: apparently glacial diamicton (till) with scattered poorly sorted gravel near top of unit)

8 BORING C209 CHAIN LAKES RESERVOIR SOUTH DAM
GE Poorly sorted silty, clayey gravel and gravelly sand. Clasts are predominantly shaley (comment, L.E. Jackson jr.,: apparently glacial outwash and alluvial fan sediments of the Chain of Lakes valley, a former meltwater channel)
R Weathered siltstone

9 BORING C211 CHAIN LAKES RESERVOIR
L Organic rich lacustrine clays
LE Inorganic clay, highly plastic
Tlm Gravelly silty and sandy clay low plasticity. Boulder size limestone and sandstone clasts encountered (comment, L.E. Jackson jr.,: apparently glacial diamicton (till) for the most part based upon correlation with surface exposures)
Gl? Well to poorly sorted gravels. Shale is the predominant clast lithology

10
E Very fine sand and silt, massive. Contains a buried soil. Unit fills topographic lows
Glm Poorly sorted bouldery gravel. Matrix silty sand. Clasts 30 cm in length are common
Tlm Stony light grey glacial diamicton (till). Stones are almost entirely limestone and dolostone and the silty sandy matrix is predominantly carbonate
Glm Boulder gravel, massive
R Shale

SUBSURFACE UNITS

Post Glacial
O Peat and degraded peat
E Eolian fine sand and silt
L Lacustrine sand, silt and clay

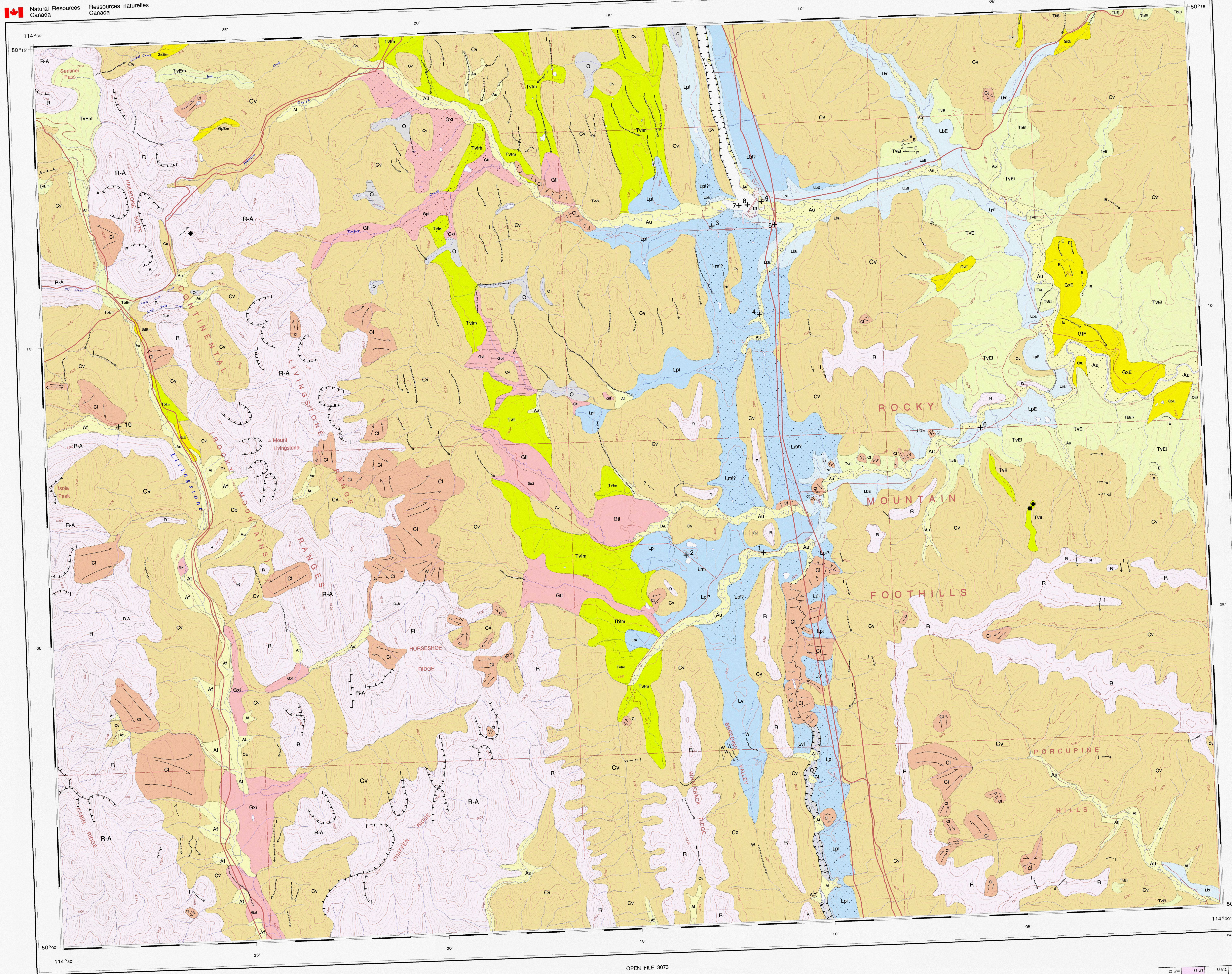
Erratics Train Glaciation
LE Laminated and thinly bedded glaciolacustrine sand silt and clay
GE Outwash gravels (Rocky Mountain and, Foothills, and Canadian Shield provenance)
TEl Erratics Train Till (mixed Rocky Mountain, Foothills and Canadian Shield provenance in the east and grading westward to purely Rocky Mountain provenance)

Interglacial?
Al Alluvial sand and gravel

Penultimate glaciation or older
Ll Laminated and thinly bedded glaciolacoustrine silty clay
Gl Outwash gravels (Rocky Mountain and Foothills provenance)
Tlm Till of Rocky Mountain Front Ranges and Foothills Provenance

Uncertain Age
L? Glaciolacustrine sediments deposited during either Erratics Train Glaciation or the penultimate glaciation
Gl? Coarse gravel outwash entirely of Rocky Mountain Front Ranges and Foothills provenance. May have been deposited at the end of the penultimate glaciation or during the onset of the Erratics Train Glaciation

Preglacial
R Sandstone and shale bedrock



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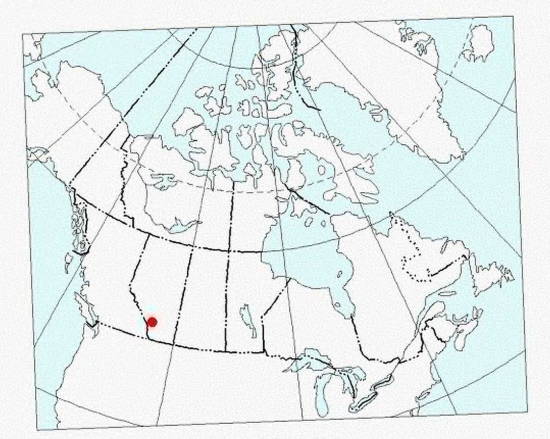
LOCATION MAP

Geology by L. E. Jackson Jr., 1975 and 1993

Digital cartography by Louis P. Renaud, Geological Survey of Canada

Electrostatic plot produced by the Geological Survey of Canada

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

OPEN FILE 3073
SURFICIAL GEOLOGY

LANGFORD CREEK

ALBERTA

Scale 1:50 000 - Échelle 1/50 000

Kilometres 1 0 1 2 3 4 Kilomètres

Transverse Mercator Projection
CM 114°15', Scale Factor 1
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Projection transverse de Mercator
MC 114°15', facteur d'échelle 1
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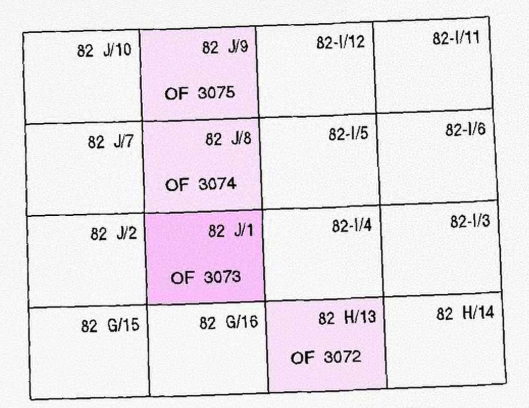
Digital base map from Surveys, Mapping and Remote Sensing Branch published at 1:50 000 scale. Generalized and modified by the Geological Survey of Canada

Copies of the topographical edition of this map may be obtained from the Canada Map Office, Department of Natural Resources Canada, Ottawa, Ontario, K1A 0E9

Mean magnetic declination 1995, 18°14' E, decreasing 6.9' annually. Readings vary from 18°04' E in the SE corner to 18°20' E in the NW corner of the map

Elevations in feet above mean sea level



82 J/10	82 J/9 OF 3075	82-I/12	82-I/11
82 J/7	82 J/8 OF 3074	82-I/5	82-I/6
82 J/2	82 J/1 OF 3073	82-I/4	82-I/3
82 G/15	82 G/16	82 H/13 OF 3072	82 H/14

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

LEGEND

This legend is common to Open Files 3072 to 3075, coloured legend blocks indicate map units that appear on this map

QUATERNARY
HOLOCENE

POST ERRATICS TRAIN GLACIATION

m **MADE LAND:** *urban artificial fill and mine waste*

Mn **NEOGLACIAL TILL:** *diamicton, stony. Forms end and lateral moraines (denoted by symbol) and ground moraine. May contain glacial ice. Thickness 10 m to discontinuous*

O **ORGANIC DEPOSITS:** *water-saturated sphagnum sp. peat and organic silt formed predominantly by the accumulation of vegetative material in bogs, fens, and swamps. Organic deposits are usually underlain by lacustrine silts and clays. Thicknesses up to 5 m*

EOLIAN DEPOSITS: *sand and silt transported and deposited by wind*

Eb **Eolian blanket:** *sand, well sorted, massive. Forms gently undulating plains marked by cresent-shaped dunes. 1 to 3 m thick*

Ev **Eolian veneer:** *silt and fine sand, well sorted, massive < 1m thick in scattered dunes and patchy coverings (indicated by pattern where known)*

COLLUVIAL DEPOSITS: *Stony diamicton resulting from the breakdown of bedrock through physical and chemical weathering and reworked and transported by gravitational processes . Colluvial deposits commonly include reworked glacial sediments with 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 with areas of exposed bedrock*

Ca **Colluvial apron sediments:** *diamicton, bouldery, and sands and gravels, poorly sorted and stratified. Forms 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 upslope limit to up to 10 m or more in the thickest part of the apron*

Cc **Rockfall sediments:** *rockfall deposits, bouldery, angular. Form cone shaped landforms at the angle of repose below steep bedrock slopes. Thickness range from 0 at the margins to 10 m near the midpoint of the cone*

Cl **Landslide Sediments:** *diamicton formed of broken rock, soil and glacial deposits within the limits of recent glaciation. Forms a hummocky or ridged topography with ridges transverse to direction of movement. Thickness variable, may range up to 10 m or more (direction of movement indicated by arrow)*

Cu **Undivided Colluvial Sediments:** *hummocky apron terrain adjacent to mountainous uplands possibly of mass wasting origin*

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

Ap **Flood plain sediments:** *gravel and sand, massive to stratified, moderately to well sorted and are locally overlain by or include lacustrine silt and clay and minor peat and organic silt deposited in abandoned channels and along flood-plain 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 flood plain origin now isolated from flooding by stream incision. Thickness ranges from a discontinuous covering on bedrock to several m. Where alluvial terraces are cut into glaciofluvial plains, total thicknesses of gravel and sand up to 5 m*

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 by debris flows. Thickness up to 10 m*

Au **Undivided alluvial sediments:** *floodplains, fans, and terraces that cannot be subdivided at this map scale*

WISCONSINAN

ERRATICS TRAIN GLACIATION

ALLUVIAL DEPOSITS: *Gravel and sand deposited by streams that were not fed by glacial meltwaters but were graded to ice margins*

AtE **Alluvial terrace sediments:** *Gravel and sand, stratified, moderately to well sorted. Sediments are of flood plain origin now isolated from flooding by stream incision. Thickness 1 to 5 m*

GLACIOLACUSTRINE DEPOSITS: *well stratified sand, silt and clay deposited in lakes ponded by glacial ice. Where deposition was distant from ice margins, glaciolacustrine sediments underlie plains or gently rolling terrain. Where deposition was proximal to ice, they may underlie ridged, hummocky, or pitted terrain caused by subsequent ice meltout*

LvE **Glaciolacustrine veneer sediments:** *silt, clay and fine sand, well stratified,thinly bedded to laminated or discontinuous. Thickness < 1 m thick to discontinuous*

LbE **Glaciolacustrine blanket sediments:** *silt, clay and fine sand surface morphology conforms to underlying topography. Thickness 1 to 3 m*

LpE **Glaciolacustrine plain sediments:** *silt, clay and fine sand, thinly bedded to laminated. Surface morphology is a plain and underlying topography is totally or largely obscured by these sediments. Thickness 1 to 20 m*

cLpE **Glaciolacustrine plain sediments (heavy clay phase):** *heavy clay and silty clay, laminated. Surface morphology is a plain, includes sediments from postglacial lakes. Thickness 1 to 20 m*

LmE **Rolling glaciolacustrine plain sediments:** *fine sand, silt, and clay, thinly to massively bedded, surface morphology undulating with 1 to 2 m of local relief. Underlying topography is totally or largely obscured by these sediments. Thickness 1 to 20 m*

LxE **Ice-contact glaciolacustrine complex sediments:** *silt and sand, gravel, diamicton lenses and dropstones may comprise up to 10 percent 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. Thickness 5 to 10 m*

GLACIOFLUVIAL DEPOSITS: *Sand, gravel and minor silt and clay deposited by streams flowing away from, or in contact with glacial ice, including deltas graded to former glacial lakes. Sorting ranges from good to poor and stratification from thin bedded to massive. Sediments often display evidence of syndepositional collapse due to meltout of buried or supporting ice*

GpE **Glaciofluvial plain and fan sediments:** *gravel and sand, massive to thick bedded, former outwash plains and fans. Thickness 1 to 10 m*

GtE **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*

GdE **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 in a former glacial lake. Thickness ranges from 5 to 10 m*

GxE **Glaciofluvial ice stagnation complex sediments:** *sand, gravel, diamicton and minor silt and clay, thin bedded to massive. Bedding is frequently contorted and folded due to syndepositional ice meltout. Surface morphology includes hummocks, kettles, esker and crevasse-fill ridges 2 to 10 m in relief with minor elements of units* **Gp** *and* **Gt**. *Thickness 5 to 10 m*

GuE **Undivided glaciofluvial and ground moraine sediments:** *co-occurring glaciofluvial sediments and ground moraine too variable to resolve at the scale of mapping. Thickness 1 to 5 m*

MORAINAL DEPOSITS (TILL): *diamicton (pebble to boulder size clasts suspended in a poorly sorted clay to sand size matrix) deposited directly from glacial ice; redeposition, where it has occurred, has been by gravity-induced flow and/or deformation. Tills of two provenances were deposited during the Erratics Train Glaciation:* **T El** *contains clasts of Rocky Mountain Front and Main ranges Precambrian and Paleozoic limestone, dolostone and quartzite, Foothills and Interior Plains Mesozoic and lower Tertiary sandstone, mudstone and coal, and Canadian Shield plutonic and metamorphic rocks,* **T Em** *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). Some trace amounts of Canadian Shield provenance clasts may be locally present where montane ice overran preexisting drift containing Canadian shield provenance clasts*

TvEl, TvEm **Till veneer:** *< 1 m thick or discontinuous with patches of exposed bedrock or colluvium.* **TvEm** *generally contains more and coarser pebble and larger clasts than does* **TvEl** *and both may contain extensive areas of thin (<1 m) and patchy colluvium*

TbEl, TbEm **Till blanket:** *1 to 5 m of diamicton that conforms to the underlying topography. TbEm generally contains more and coarser pebbles and larger clasts than does* **TbEl**

ThEl, ThEm **Hummocky moraine sediments:** *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 of up to 30 m. Thickness may be tens of m*

WISCONSINAN OR PRE-WISCONSINAN

EARLY ADVANCE OF ERRATICS TRAIN GLACIATION OR PENULTIMATE GLACIATION

GLACIOLACUSTRINE DEPOSITS: *well stratified sand, silt, clay and minor gravel and diamicton deposited in lakes ponded by glacial ice*

Lvl **Glaciolacustrine Veneer Sediments:** *silt, clay and fine sand, well stratified, thinly bedded to laminated or discontinuous. Thickness < 1 m thick to discontinuous*

Lpl **Glaciolacustrine plain sediments:** *clayey silt with minor fine sand, thinly bedded to laminated 1 to 5 m thick*

Lml **Rolling Glaciolacustrine Plain Sediments:** *fine sand, silt, and clay, thinly to massively bedded, surface morphology undulating with 1- 2 m of local relief. Underlying topography is totally or largely obscured by these sediments. Thickness 1 to 20 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 thin bedded to massive. Sediments may display evidence of syndepositional collapse due to meltout of buried or supporting ice. Provenance ranges from entirely montane (Precambrian and Paleozoic limestone, dolostone, argillite and quartzite (may include Precambrian igneous rocks south of Crowsnest river) in the area of the former termini of montane glaciers and include sandstone, mudstone, conglomerate and Canadian Shield provenance granitic and metamorphic lithologies within areas formerly covered by the Laurentide ice sheet*

Gpl **Glaciofluvial plain sediments:** *gravel and sand, massive to thick bedded, former outwash plains and fans. Thickness 1 to 10 m*

Gtl **Glaciofluvial terrace sediments:** *gravel and sand, massive to thick bedded, former outwash plains and fans incised into a succession of terraces. Thickness 1 to 10 m*

Gdl **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 in former glacial lake. Thickness ranges from 5 to 10 m*

Gxl **Glaciofluvial ice stagnation complex sediments:** *sand, gravel, diamicton and minor silt and clay, thin bedded to massive. Bedding is frequently contorted and folded due to syndepositional ice meltout. Surface morphology includes hummocks, kettles, esker and crevasse-fill ridges 2 to 10 m in relief with minor elements of* **Gpl** *and* **Gtl**. *Thickness 5 to 10 m*

MORAINAL DEPOSITS (TILL): *diamicton deposited directly from glacial ice with redeposition by gravity induced flow or deformation. Tills of two provenances were deposited: a mixed Laurentide-Rocky Mountain and Foothills provenance till* **(T ll)** *and a Rocky Mountain-Front Ranges provenance till* **(T lm)** *lacking any shield derived material. In* **Tll**, *sandstone and siltstone clasts derived from local bedrock are almost totally disaggregated near the surface. It is recognizable as a diamicton only below 60 cm depth.* **T lm** *sediments generally contains more and coarser pebble and larger clasts than do* **T ll** *sediments*

Tvll, Tvlm **Till veneer:** *< 1 m thick or discontinuous.* **Tvlm** *generally contain more and coarser pebble and larger clasts than does* **Tvll** *and both may contain extensive areas of thin (< 1 m) and patchy colluvium*

Tbll, Tblm **Till blanket:** *1 to 5 m thick but conforming to underlying topography*

Thll, Thlm **Hummocky Moraine Sediments:** *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 of up to 30 m. Thickness may be tens of m*

EARLY PLEISTOCENE OR PLIOCENE

GLACIAL OR NONGLACIAL

MORAINAL DEPOSITS? (TILL?): *stony diamicton, cemented in part to a calcrete. Contains striated clasts on exclusively montane origin*

TbP **Till? blanket:** *cemented stony diamicton. Thickness 2-3 m. Rests on a succession of similar sediments of glacial or nonglacial origin*

PALEOZOIC TO EARLY TERTIARY

R *Sandstone, siltstone, shales, conglomerate, coal and minor volcanic rocks of early Tertiary and Mesozoic age and limestone, dolostone and quartzite of Mesozoic age (includes areas of thin colluvial cover, blockfields, sorted stone polygons in alpine areas)*

R-A *Bedrock subject to rapid mass wasting processes (rockfall and snow avalances)*

Geological boundary (defined, assumed, inferred)
Neoglacial lateral and end moraine N
Rock glacier
Cirque (**E**-Erratics Train Glaciation; **I**- penultimate montane glaciation, **?**- degraded cirque of uncertain age) E
Arete (**E**- Erratics Train Glaciation; **I**- older degraded cirque, penultimate montane glaciation or older) E
Meltwater channel; large, small (arrow indicates flow direction), (**E**- Erratics Train Glaciation; **I**- penultimate glaciation; **?**- age unknown) E
edge of ice walled channel E
Esker: flow direction defined, undefined (**E**- Erratics Train Glaciation; **I**- penultimate glaciation; **?**- age unknown) E >>>>>>> ><><><>
Streamlined glacial bedform: ice flow direction known, unknown (**E**- Erratics Train Glaciation; **I**- penultimate glaciation) E W
Moraine (**E**- Erratics Train Glaciation; **I**- penultimate glaciation; **?**- age unknown)
End and lateral E
Recessional E
Radiocarbon age ◆
Vertebrate fossil locality Ⓕ
Ice limit (**E**- Erratics Train Glaciation; **I**- early Erratics Train Glaciation or penultimate glaciation; **?**- age unknown) E
Former ice contact face in stratified drift
Stratigraphic section 2 +
One or more Foothills Erratics Train Erratic > 1 m in length ▲
Montane erratic close to or at the all time upper limit of montane glaciation ■
Continental erratic at or near the all time upper limit of continental glaciation ●
Lacustrine veneer
Organic veneer
Eolian veneer
Landslide, arrows indicate direction of movement

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