Energy, Mines and Resources Canada / Énergie, Mines et Ressources Canada

GEOLOGICAL SURVEY OF CANADA / COMMISSION GÉOLOGIQUE DU CANADA

DESCRIPTIVE NOTES

Introduction

Vast stretches of ground moraine interspersed with hummocky terrain, typical of the glaciated southern Prairies, occur over most of the study area. The Cypress Hills upland in the west-central part of the area, however, contrasts markedly with the surrounding morainic terrain. The upland consists of late Tertiary erosional remnants which were modified mostly by fluvial and mass wasting processes during Quaternary nonglacial intervals and while they stood as nunataks during Pleistocene glaciations.

Mapping the surficial geology of the Cypress Lake map area was begun in 1983 and completed in 1986. Airphoto interpretation, field study of exposures, shallow drilling and back hoe trenching provided the controls for establishing map units, studying the stratigraphy, and establishing age relationships.

Bedrock Geology

The main topographic elements of the Cypress Hills upland are the West, Centre, and East blocks which are erosional remnants underlain mainly by Tertiary bedrock. In addition, broad valleys occupied by streams such as Battle, Davis, Fairwell, and Conglomerate creeks were cut in bedrock before the onset of Pleistocene glaciations. Middle and Battle creeks on the south-facing slopes of the upland and Gap Creek on the north-facing slope appear to follow ancestral drainage lines.

The bedrock geology of the map area, shown on the reverse of the surficial geology map is taken largely from Whitaker (1976). The drift surrounding the upland is generally underlain by the Cretaceous Bearpaw Formation composed of silt, clay, and sand of marine origin. The Tertiary Ravenscrag Formation, composed of sand, silt, and clay of mainly terrestrial origin, underlies drift over a broad bedrock rise in the east-central part of the area and underlies discontinuous drift over parts of the highest pediments flanking the Cypress Hills upland. Most of the drift-free part of the Cypress Hills upland is underlain by the late Tertiary Cypress Hills Formation composed of quartzite and chert gravel, sand, silt, and clay of terrestrial origin. Isolated patches of calcrete and loess, which veneer the Cypress Hills Formation, are probably of late Tertiary to Middle Pleistocene age (Vreeken et al., 1989).

Surficial Geology

Glacial deposits are the most common surficial materials in the Cypress Lake area. They consist mainly of till along with sand, silt, and clay and minor gravel deposited in glacial lakes and as outwash in contact with glacier ice and beyond the glacier margins. Fluvial, mass wasting, and eolian processes were active on the upland slopes beyond the drift belts during much of the Quaternary; however, except for modern deposits (Goulden and Sauchyn, 1986), most of the resulting sedimentary record has been removed by these processes.

Two tills, commonly seen in stream cuts and identified in shallow boreholes, appear to be of lodgement and meltout origin. The matrix of the tills is typically a silty loam with less than 5% clasts of Shield, eastern carbonate, and local bedrock types. The lower till is compact and jointed, whereas the upper till is looser, contains sand lenses, and has a higher proportion of far-travelled clasts. The contact between tills is typically gradational and lacks evidence of subaerial weathering and biota. The upper till, typically several metres thick over the ground moraine plains, is absent in places and either the lower till or bedrock forms the surface.

The surface drift is mostly of Late Wisconsinan age, notwithstanding the "old" appearance of some surfaces. The Late Wisconsinan age is assigned on the basis of radiocarbon dates in the 14 to 9 ka range that were obtained from sediments associated with hummocky moraine (Klassen and Vreeken, 1987).

Ground moraine covers much of the southern and northeastern parts of the map area. The surfaces generally reflect the topography of the underlying bedrock and are nearly flat to gently irregular in the south and broadly rolling in the northeast. Ground moraine consists primarily of till, generally less than 15 m thick, although thicknesses of greater than 60 m occur in the southeastern part of the area.

Hummocks, ridges, and intervening depressions with 10 to 30 m local relief form the distinctive hummocky moraine landscape. Belts of hummocky moraine north of Frenchman Valley lack the moraine plateau features common on the hummocky moraine south of the valley. Till forms much of the hummocky moraine, although ice contact and glaciolacustrine sediments are common in belts transitional to hummocky glaciolacustrine deposits and within moraine plateaus. The thickest drift occurs in some of the hummocky moraine belts.

The outwash plain along the northern boundary of the western part of the map area is the southern terminus of an extensive glaciofluvial and glaciolacustrine complex within the Prelate area (72K) to the north (David, 1964). Elsewhere, outwash is restricted to meltwater channels and a few patches over ground moraine. Outwash deposits consist mainly of sand and gravel along with some silt. The outwash plain gravel consists mainly of Shield, eastern carbonate, and local quartzite rock types, whereas the gravels in meltwater channels across the upland are primarily local quartzite. Thicknesses of outwash, estimated on the basis of exposures and local relief, range from 2 to 20 m.

Postglacial sediments are mappable within large valleys. Sand and quartzite gravel are common within the valleys heading in the Cypress Hills upland and minor uplands in the southern part of the map area. These sediments reflect the primary source area in Tertiary gravels and sands, although scattered erratics indicate that they also carried glacial meltwater. Channel bank exposures suggest that these deposits are 5 to 10 m thick, but may reach 30 m where tributaries join Frenchman Valley. Valley fills of silty to sandy alluvium and colluvium some 20 to 75 m thick occur within Frenchman River and Swift Current Creek valleys. Silty to clayey sediments of alluvial, colluvial, and in part lacustrine origin and 8 to 20 m thick occur within the postglacial valleys beyond the Cypress Hills upland.

Mass wasting deposits consisting of silty sheetwash and, in places, bedrock slump blocks form the concave lower slopes of the valley walls along Frenchman River valley below Cypress Lake and along Swift Current Creek. These fine textured sediments reflect the Cretaceous and Tertiary source rock commonly exposed along the upper parts of the valley walls. Cutbanks at the junctions of tributary and trunk streams expose interbedded deposits of alluvium and colluvium up to 8 m high that thicken towards the valley wall.

Acknowledgments

The late S.H. Richard made available field maps showing surficial materials identified during four months of field work in 1964. Lesley Sushelnitsky compiled airphoto interpretated data on base maps. W.J. Vreeken, Queen's University, Kingston, conducted independent and joint studies with the author during parts of the summers of 1983 to 1986. Byron Bawnson, Mark Pawson, and Victor Levson compiled map data, conducted some independent field work, and assisted the author in the field during the summers of 1984, 1985, and 1986, respectively.

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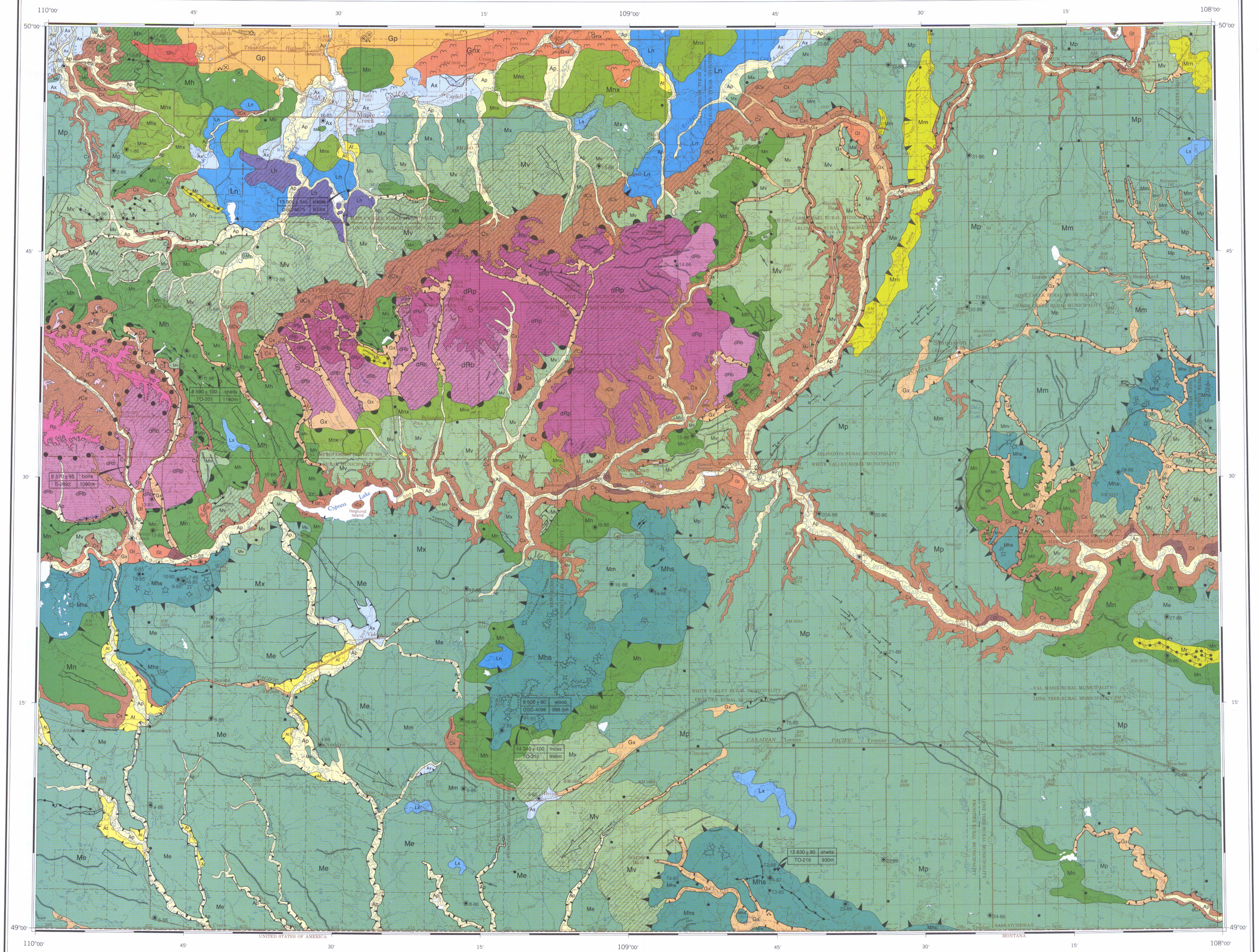
Geological boundary
Calcrete or loess exposure
Drumlinoid ridge, groove and fluting (ice flow direction assumed, parallel to feature)
Boulder pavement striae (ice flow direction assumed)
Pebble fabric parallel to ice flow
Moraine ridge (major, minor)
Moraine plateau
Ice thrust ridge (teeth on ice-push side)
Kame (gravel and sand hill)
Esker (directrion of flow assumed, unknown)
Meltwater or spillway channel with minimal postglacial erosion (major, minor)
Escarpment
Buried valley
Landslide scar
Areas of gullying
Sand dune field
Gravel pit
Clay pit
Till sample site
Drill site 23-86
Trench T8-85
Mazama ash sample site
Limit of glacial deposits
Maximum limit of Late Wisconsinan glacier
Minimum limit of Late Wisconsinan glacier
Coincident maximum and minimum limits of Late Wisconsinan glacier
Inferred ice flow direction
Radiocarbon date

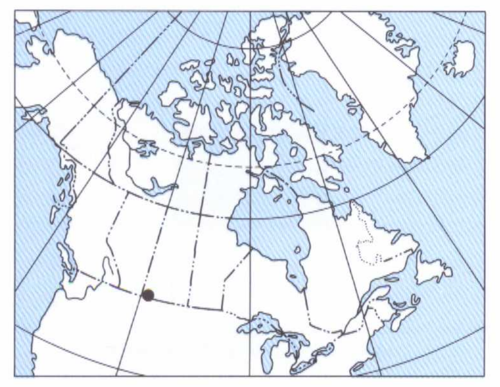
Age	Material
Lab no	Elevation(m)

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

Published 1991



INDEX MAP

Geology by R.W. Klassen 1983-1986

Geological cartography by the Geological Survey of Canada

Colour separations were produced using digital methods

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

MAP 1766A

SURFICIAL GEOLOGY

CYPRESS LAKE

SASKATCHEWAN

Scale 1:250 000 - Échelle 1/250 000

Kilometres 5 0 5 10 15 20 Kilomètres

Universal Transverse Mercator Projection

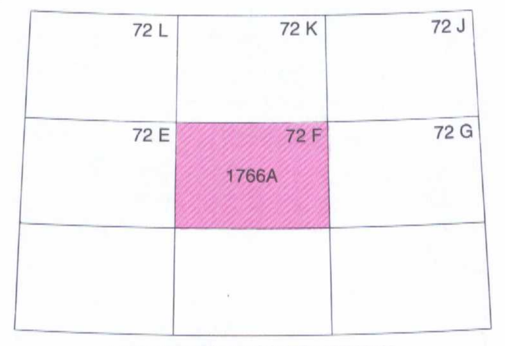
Projection transverse universelle de Mercator

Base map at the same scale published by the Surveys and Mapping Branch in 1977

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

Mean magnetic declination 1991, 15°23'East, decreasing 6.6' annually. Readings vary from 14°33'E in the SE corner to 16°14'E in the NW corner of the map

Elevations in feet above mean sea level



NATIONAL TOPOGRAPHIC SYSTEM REFERENCE

LEGEND

SURFICIAL MATERIALS
QUATERNARY
HOLOCENE

POSTGLACIAL ENVIRONMENT

COLLUVIAL DEPOSITS: massive to weakly bedded sediments from less than 1 m to 30 m thick; derived from local bedrock and drift and deposited by mass movement and fluvial processes along and below steep upland slopes and valley walls; clast lithologies are mainly local rock types

Cf — ***Colluvial fan:*** *silt, sand, gravel, and bedrock rubble formed by coalescing of fans and aprons along walls of major valleys; includes alluvial and sheetwash sediments*

Cx, dCx, rCx — ***Colluvial complex:*** *silt, sand, gravel, reworked drift, and bedrock.* **Cx**, *derived from drift and bedrock;* **dCx**, *derived mainly from drift;* **rCx**, *derived mainly from bedrock*

ALLUVIAL DEPOSITS: bedded sediments generally from 10 to 30 m thick; derived from drift and local bedrock and deposited mainly by recent streams along valley bottoms and across lake plains; flat to gently irregular terrain; clast lithologies are mainly quartzite, igneous and metamorphic Shield types, and carbonates

Ap — ***Alluvial plain:*** *silt and sand with minor clay and gravel beneath floodplains; includes minor terraces and fans*

At — ***Alluvial terrace:*** *silt and sand, minor clay and gravel form prominent features along valleys in the southwest part of the area; locally includes outwash and glaciolacustrine sediments*

Ax — ***Alluvial complex:*** *clay, silt, and sand from 5 to 20 m thick; alluvium and lacustrine and glaciolacustrine sediments, in part reworked by recent streams*

Lx — *LACUSTRINE COMPLEX: clay, silt, and sand up to 5 m thick; deposited in local lake basins as complex of ephemeral lake sediments and colluvium*

LATE WISCONSINAN

PROGLACIAL AND GLACIAL ENVIRONMENTS

GLACIOLACUSTRINE DEPOSITS: bedded sediments from 5 to 50 m thick; deposited in glacial lakes mainly over stagnant ice; gently irregular to hummocky terrain with 2 to 20 m local relief

Lh — ***Hummocky glaciolacustrine deposits:*** *mainly silt and sand with some clay and lenses of diamicton and gravel; hummocks have a smooth, rounded aspect with 10 to 20 m local relief*

Ln — ***Glaciolacustrine plain:*** *mainly silt and sand with some clay; gently irregular to low hummocky terrain with 2 to 10 m local relief*

GLACIOFLUVIAL DEPOSITS: bedded to weakly bedded sand and gravel with minor silt; generally from 5 to 20 m thick; clast lithologies are igneous and metamorphic Shield types along with carbonates and local quartzite and chert; deposited by glacial meltwater along and beyond the glacier margin

Gp, Gt, Gnx — **Gp, *outwash plains:*** *sand and gravel; gently irregular to low hilly terrain with 5 to 10 m local relief;* **Gt, *outwash terraces***: *silt, sand, and gravel form prominent terraces within meltwater channels;* **Gnx, *outwash plains***: *marked by sand dunes in zones transitional to glaciolacustrine sediments*

Gh — ***Kame complex:*** *sand, gravel, and minor diamicton consisting of clusters of hills and knolls with 10 to 20 m local relief*

Gx — ***Glaciofluvial complex and colluvium:*** *silt, sand, gravel, and bedrock rubble form slopes, terraces and valley bottoms; occurs within abandoned channels where mass wasting processes dominate over fluvial processes*

GLACIAL ENVIRONMENT

GLACIAL DEPOSITS: dominantly till deposited directly by glacier ice; some diamicton, clay, silt, sand, and gravel of glaciofluvial and glaciolacustrine origin; thicknesses from less than 1 m on bedrock benches to some 80 m beneath some hummocky moraines; typical till has roughly equal proportions of clay, silt, and sand with minor gravel; clast lithologies are mostly igneous and metamorphic Shield types along with carbonates and local quartzite and chert

Mh, Mhx, Mn, Mnx — ***Hummocky moraine:*** *silty loam till, 15 to 40 m thick, forms hummocks and depressions which generally occur in broadly linear belts reflecting the trend of former ice margins.* **Mh**, *relief 10 to 30 m;* **Mhx**, *transitional to hummocky glaciolacustrine deposits;* **Mn**, *5 to 10 m relief;* **Mnx**, *transitional to hummocky glaciolacustrine deposits*

Mhs — ***Hummocky dead ice moraine:*** *silty loam till some 15 to 80 m thick forms hummocks and depressions; 10 to 30 m relief; locally includes clay, silt, sand, and gravel of fluvial and glaciolacustrine origin associated with moraine plateaus and anastomozing ridge complexes; moraine commonly mantles low bedrock uplands*

Mr, Mrn — ***Ridged moraine:*** *silty loam till intercalated with bedrock; 10 to 30 m thick; consists of hummocks and subparallel ridges and intervening depressions that occur in belts formed by ice thrusting along former ice margins.* **Mr**, *relief 10 to 30 m;* **Mrn**, *relief 5 to 10 m*

Mp, Me, Mm, Mx — ***Ground moraine:*** *silty clay loam till and glaciolacustrine sediments from 2 to 15 m thick over flat to broadly rolling bedrock plains.* **Mp**, *flat to gently irregular till plains; patchy veneer of silt (loess?) occurs in the northeast part of the area;* **Me**, *flat to gently irregular till plains in part eroded and reworked by glaciofluvial, glaciolacustrine and eolian processes;* **Mm**, *broadly rolling surfaces with 10 to 30 m of relief between swales;* **Mx**, *flat to gently irregular plains underlain by till and glaciolacustrine sediments*

Mv — ***Patchy ground moraine:*** *flat to irregular pediment surfaces in Cretaceous and Tertiary bedrock veneered with reworked Tertiary gravel and sand, patches of till and glaciolacustrine sediments*

BEDROCK, REWORKED BEDROCK, AND RESIDUAL DRIFT DEPOSITS

TERTIARY AND PLEISTOCENE

Rp, dRp — ***Bedrock plateaus:*** *Cypress Hills Formation gravel, sand, and silt.* **Rp**, *nearly flat plateau remnants that form the unglaciated parts of the Cypress Hills;* **dRp**, *includes reworked bedrock and rare glacial erratics on nearly flat to irregular surfaces that form the highest glaciated parts of the Cypress Hills*

Rb, dRb — ***Bedrock pediments and benches***: *Ravenscrag and Cypress Hills formations gravel, sand, silt, and clay.* **Rb**, *remnants of benches along major valleys;* **dRb**, *includes reworked sediments and rare glacial erratics on nearly flat to irregular pediments flanking the highest glaciated parts of the Cypress Hills*

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1991: Surficial geology and drift thickness, Cypress Lake, Saskatchewan; Geological Survey of Canada, Map 1766A, scale 1:250 000