LEGEND

UNIT SYMBOL	UNIT NAME	MATERIAL	TOPOGRAPHY	RELIEF	THICKNESS
RECENT					
	ORGANIC TERRAIN				
O	Bog, fen, swamp, marsh	peat; woody to fibrous to mucky; often includes one or more of sand, silt, clay, or marl near the base	generally flat; some small hummocks on bog and fens	less than 1 m	generally more than 2 m
Ot	Thin organic cover	similar to above; peat; woody to fibrous to mucky; often includes sand, silt, clay, or marl near base	flat or reflects underlying topography	less than 1 m	less than 2 m
	ALLUVIUM AND COLLUVIUM				
CA	Gully, creek valley, scarp slump	thin discontinuous colluvial cover on valley slopes; thin alluvial materials along creeks; mixed Pleistocene glacial and/or bedrock material in slump areas	variable; hummocky to rolling to flat	variable	variable; generally less than 2 m except in slumped areas
	Alluvium				
Atd	Depositional terraces	sand, silt, and clay with gravel in some places, some organic fragments	flat to rolling	generally less than 1 m	generally more than 2 m
Ate	Erosional terraces	thin discontinuous lag of gravel, sand, and minor silt	variable	variable; generally less than 2 m	variable over short distances
Au	Undifferentiated alluvium	sand, silt, and clay with some gravel locally; includes some colluvium on steeper portions of valley walls	variable; flat to rolling to hummocky	variable; generally less than 3 m	variable
AS	Stream alluvium	sand, silt, and clay poorly sorted in places; some organic fragments; a few small discontinuous gravel lenses	flat	less than 1 m	generally more than 2 m
	LACUSTRINE DEPOSITS				
fL	Fine textured lacustrine deposits	silt and clay, associated with recently drained lake; includes thin peat cover in places	flat	less than 1 m	generally less than 2 m
sL	Sandy lacustrine deposits	sand with minor silt, clay or gravel in places	generally flat but locally may form ridges	generally less than 1 m	generally less than 2 m
	EOLIAN DEPOSITS				
E1	Eolian sand	medium- to fine-grained	hummocky to flat	less than 3 m	generally more than 2 m
E2	Eolian sand	medium- to fine-grained	hummocky	more than 3 m	more than 2 m
Et	Thin eolian cover	medium- to fine-grained sand	flat to hummocky to rolling in dunes	less than 3 m	less than 2 m
Ed	Discontinuous eolian cover	medium- to fine-grained sand	hummocky to rolling	more than 3 m	variable; often more than 2 m
PLEISTOCENE					
	GLACIOLACUSTRINE DEPOSITS				
cLGf	Fine textured glaciolacustrine deposits	clay to silty clay; massive to laminated, stone-free	flat, locally hummocky or rolling	generally less than 1 m; locally less than 3 m	generally more than 2 m
cLGh	Fine textured glaciolacustrine deposits	clay to silty clay; massive	hummocky	generally more than 3 m	more than 2 m
fLGf	Fine textured glaciolacustrine deposits	clay and silt; laminated but locally massive or rhythmically laminated; few to no stones	flat, locally hummocky or rolling	less than 3 m	generally more than 2 m
fLGu	Fine textured glaciolacustrine deposits	clay and silt; laminated but locally massive or rhythmically laminated; few to no stones	variable; flat, hummocky or rolling, may reflect underlying topography	generally less than 3 m	no data
$LGf	Fine textured glaciolacustrine deposits	silt to clayey silt; minor sandy silt; few to no stones	flat, locally hummocky or rolling	less than 3 m	generally more than 2 m
mLG	Mixed glaciolacustrine sediments	interbedded clay and silt with till layers and pockets; the proportion of till generally increases with depth; some stones	flat to hummocky	generally less than 3 m	generally more than 2 m
sLG	Sand and silt, glaciolacustrine deposits	fine- to medium-grained sand, some silt, minor clay; laminated but locally massive or rhythmically bedded; a few stones in places	hummocky to flat	generally less than 3 m; locally may exceed 7 m	more than 2 m
sLGp	Pitted delta	sand, silt and sand, minor clay and gravel; some till pockets and stones; laminated to massive	hummocky, locally flat or rolling	generally more than 3 m; locally exceeds 30 m	more than 2 m
uLG	Undifferentiated glaciolacustrine deposits	generally clay or silt and clay; in some areas includes sand and some pebbles	flat or reflects underlying topography	generally less than 3 m	more than 1 m
LGt	Thin glaciolacustrine cover	same texture symbols as for the above LG units; fine sediments; may include some mixed sediments near contact with till	flat or reflects underlying topography	less than 1 m	less than 2 m
LGd	Discontinuous glaciolacustrine cover	same texture symbols as for the above LG units; fine sediments; may include some mixed sediments near contact with till	flat or reflects underlying topography	less than 1 m	generally less than 2 m
LGT	Thin glaciolacustrine over till cover	lacustrine: clay, clay and silt, mixed sediments, and/or minor sand; till: sand, silt, clay, minor stones, massive; till overlying bedrock usually contains a large proportion of bedrock material; locally the lacustrine or till deposits or both may be absent	flat or reflects underlying bedrock	generally less than 3 m	total of lacustrine and till less than 2 m
	GLACIOFLUVIAL DEPOSITS				
AGK	Kame and esker	fine- to coarse-grained sand and gravel; some till pockets; generally silt and clay free	local hills or ridges	variable; generally more than 2 m and locally reaches 12 m	variable; generally more than 2 m
sAG	Outwash	fine- to coarse-grained sand; layered to massive; few to no stones	flat to rolling	generally less than 2 m	more than 2 m
sgAG	Outwash	fine- to coarse-grained sand and gravel; locally some coal; layered to massive	flat to rolling	generally less than 2 m	more than 2 m
AGd	Discontinuous outwash cover	sand, sand and gravel, lag gravel	flat or reflects underlying topography	generally less than 2 m	generally less than 2 m
	GLACIAL DEPOSITS				
Tf	Till, flat	mixed sand, silt, and clay with pebbles, cobbles and boulders; massive	flat, minor rolling or hummocky areas	less than 1 m	generally more than 2 m
Tfr	Till, flat to rolling	mixed sand, silt, and clay with pebbles, cobbles and boulders; massive	alternating areas of flat and rolling terrain that are inseparable at this map scale	less than 1 m for flat areas; less than 3 m for rolling areas	more than 2 m
Th1	Till, hummocky	mixed sand, silt, and clay with pebbles, cobbles and boulders; massive	hummocky; includes stagnant ice topography	less than 3 m	more than 2 m
Th2	Till, hummocky	mixed sand, silt, and clay with pebbles, cobbles and boulders; massive	hummocky; includes stagnant ice topography	more than 3 m	more than 2 m
Tr1	Till, rolling	mixed sand, silt, and clay with pebbles, cobbles and boulders; massive	rolling	less than 3 m	more than 2 m
Tr2	Till, rolling	mixed sand, silt, and clay with pebbles, cobbles and boulders; massive	rolling	more than 3 m	more than 2 m
Thr1	Till, hummocky to rolling	mixed sand, silt, and clay with pebbles, cobbles and boulders; massive	hummocky to rolling	less than 3 m	more than 2 m
Thr2	Till, hummocky to rolling	mixed sand, silt, and clay with pebbles, cobbles and boulders; massive	hummocky to rolling	more than 3 m	more than 2 m
Tt	Thin till cover	similar to till above but in areas where till overlies bedrock, the till may contain a large proportion of bedrock material	generally hummocky or rolling; in places reflects topography of underlying unit	generally less than 2 m; locally may exceed 10 m	generally less than 2 m
Td	Discontinuous till cover	similar to till above but in areas where till overlies bedrock, the till may contain a large proportion of bedrock material	generally reflects topography of underlying unit	less than 2 m	generally less than 2 m
TERTIARY AND UPPER CRETACEOUS					
B	Bedrock	sandstone, siltstone, and shale, minor coal and limestone; in the east half of the area sediments are often glacially deformed with the bedding folded and faulted and unit includes some incorporated quartzite gravels in places; in the west half the sediments are generally undeformed	east half: generally hummocky to rolling; west half: rolling	east half: generally less than 3 m but in places may be more than 30 m; west half: generally more than 3 m	more than 2 m

Geological boundary; defined, approximate, assumed ....

Meltwater channel ....

Glacial fluting and drumlin ....

Glacial thrust ridge ....

Eastern limit of till of mixed Laurentide and Cordilleran provenance ....

LEGEND

River or stream ....

Intermittent river or stream ....

Lake ....

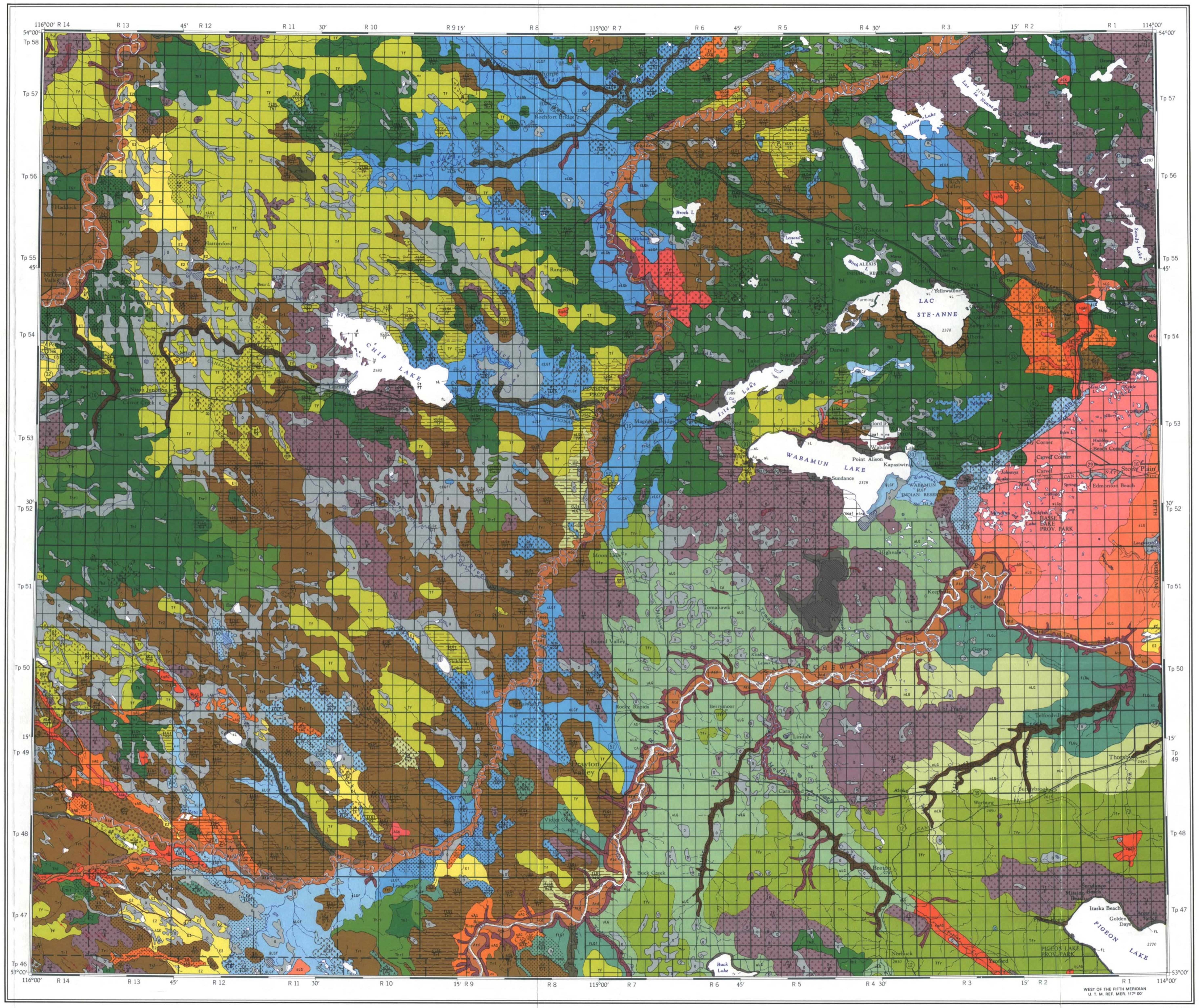
Intermittent lake ....

Road, hard surface, all weather ....

Railway ....

Township boundary ....

Section line ....



Published 1979

Drafting by L. Lehner

Cartographic editing by A.R. Campbell and R. Green

The Alberta Research Council welcomes any revisions or additional geological information known to the user.

SCALE 1:250,000

Miles 5 0 5 10 15 20 Miles

Kilometres 5 0 5 10 15 20 25 30 Kilometres

SURFICIAL GEOLOGY WABAMUN LAKE

ALBERTA

NTS 83G

Alberta Research Council

Geology by: L.D. Andriashek, 1973-1976; M.M. Fenton, 1974-1975; J.D. Root, 1973.

EXPLANATION OF UNIT SYMBOLS

A combination of letters and numbers is used to designate each map unit, for example cLGf. The upper case letter(s) designates the genetic class. The lower case letter(s) that follow (when they are present) indicate the morphology. The morphology is split into topographic type and in some cases relief. The lower case letter(s) that precede the upper case letter (when they are present) describes the texture.

One term placed above another, for example $\frac{LG}{T}$, indicates one deposit overlying another.

The map units show the material to be expected to a depth of 2 to 3 m. The color indicates the main unit and the pattern, if present, indicates the overlying unit.

SYMBOLS USED

TEXTURE	GENETIC CLASS	MORPHOLOGY
g - gravelly	A - river alluvium	d - discontinuous
s - sandy	AS - stream alluvium	f - flat
$ - silty	AG - glaciofluvial, outwash	h - hummocky
c - clayey	AGK - glaciofluvial, kames and eskers	p - pitted
f - fine textured, clay and silt	B - bedrock	r - rolling
m - mixed, all textures possibly present	CA - colluvium and alluvium, undifferentiated	t - thin, less than 2 m thick
u - undifferentiated	E - eolian	td - terrace, depositional
	LG - glaciolacustrine	te - terrace, erosional
	L - lacustrine, recent	u - undifferentiated
	O - organic	1 - local relief less than 3 m
	T - till	2 - local relief more than 3 m

Example (1): texture (clay), genetic class (glaciolacustrine), morphology (hummocky) — cLGh

Example (2): $\frac{sgAGt}{Tr2}$ = thin outwash sand and gravel overlying till which has a rolling morphology with local relief more than 3 m

DESCRIPTIVE NOTES

INTRODUCTION

The mapping scheme used in this map is modified from that of the Geological Survey of Canada. The west half and northeast quarter of the area were mapped using this scheme; however, the southeast quarter was mapped following Bayrock's (1972) scheme and the information later converted to the new scheme.

Preliminary, 1:50,000 scale, surficial geology maps, logs of 68 testholes, and the data from analyzed samples are on open file at the Alberta Research Council.

The authors acknowledge Alberta Environment for supplying testhole logs and for discussions on the preglacial topography of the area.

Physiography: The area lies within the Alberta Plains; the land slopes from an elevation of 1200 m in the southwest to 700 m in the northeast. The west half of the area consists of broad, bedrock-controlled, ridges and valleys, formed preglacially and mantled by a generally thin (<15 m) cover of drift. In the east half the morphology is primarily the result of glacial and glaciolacustrine deposition, the former producing hummocky to rolling terrain to the north and south and the latter a flat to pitted plain in the east and south-center. Drift masks all but the general outline of preglacial valleys.

The North Saskatchewan, McLeod, and Pembina Rivers are generally deeply incised into bedrock or preglacial sediment. The larger lakes fill broad lows in the post-glacial landscape (Chip Lake, Pigeon Lake, Lac St. Anne); or depressions formed, and/or enlarged by glacial thrusting (Lake Wabamun, Lac La Nonne, Sandy Lake).

Drift Thickness and Preglacial Topography: The preglacial land surface slopes northeastward and is cut by a number of valleys eroded during the Late Tertiary (Carlson, 1979). The drift thickness ranges from less than 1 m to more than 80 m.

SURFICIAL DEPOSITS

TILL

Till is unsorted sediment deposited directly from a glacier and is composed of varying proportions of all sizes of materials eroded by the glacier. Till forms the surface deposits over more than half the area and in most places underlies the lacustrine, eolian, and organic sediment.

The till is subdivided on the basis of morphology (hummocky, rolling, flat) and local relief (more than 3 m, less than 3 m) into a number of mappable units. The landform type does not imply genesis; for example, hummocky till (Th) includes both sediment deposited by stagnant ice processes and that formed by other processes such as glacial thrusting.

Composition: The surface till can be subdivided into materials of Laurentide provenance and mixed Laurentide and Cordilleran provenance. The "mixed till" contains a relatively large number of carbonate clasts and quartzite erratics up to 2 m^3. The average texture is 40 percent sand (standard deviation = 3.2) and 25 percent clay (S.D. = 4.2; N. = 8). This till is present only in Tps. 47 and 48, Rs. 13 and 14. The boundary between this and the Laurentide till is approximate and is based on field evidence and on the soils map of Twardy and Lindsay (1971).

The Laurentide till contains few carbonate clasts and no large quartzite erratics. It can be subdivided into a clayey till (30 percent sand, S.D. = 2.5; 40 percent clay, S.D. = 3.4; N. = 36) and a sandy till (40 percent sand, S.D. = 2.6; 33 percent clay, S.D. = 3.3; N. = 24). Each subunit forms the surface till at many sites. Local variations in till texture include three sites west of R. 10 (30 percent sand, S.D. = 2.5; 31 percent clay, S.D. = 1.7), three sites west of Pigeon Lake (48 percent sand, S.D. = 4.6; 19 percent clay, S.D. = 4.5), and areas of glacially thrust bedrock. These variations are probably the result of local incorporation of underlying bedrock.

Stratigraphy: The stratigraphic relationship between the two Laurentide till subunits is uncertain. The clayey till overlies the sandy till in five testholes (Tp. 52, R. 13; Tp. 48, 49, and 50, R. 9; Tp. 55, R. 2) and in the eastern one these tills are separated by stratified drift. The sandy till overlies stratified till and a clay till in two places (Tp. 54, R. 4; Tp. 57, R. 6). In a third hole the sequence is, from the top, clayey till/sandy till/sand/clayey till which suggests either (1) two clayey tills or (2) stacking of clayey till by glacial thrusting.

Glacial Thrusting: Glacial thrusting refers to the process whereby masses of underlying material are removed more-or-less intact by the glacier and carried downstream.

The thrust sediment may include till, clay, silt, sand, gravel (Babcock, Fenton and Andriashek, 1978), and, in many areas, a large amount of bedrock material. Thrusting can extend to a depth of at least 30 m. The thrust sediment may be deposited immediately down glacier of the source depression or moved farther, and form either small hills (<2 m high, <0.02 km^2) or large hills and ridges (>10 m high, >2.5 km^2).

The glacially thrust terrain is extensive in the east and has been recognized in many places where the bedrock is near the surface (unit $\frac{Tt}{B}$); in the area covered by lacustrine sediment southwest of Lake Wabamun, and southwest of a line through Lac La Nonne and Sandy Lake. This terrain has been recognized in only a few areas in the west: around Chip Lake and near Mayerthorpe.

GLACIOFLUVIAL DEPOSITS

Glaciofluvial sands and gravels were laid down as terrace or sheet deposits in and adjacent to most major meltwater channels. In the west major sources of sand and gravel exist in terraces in Tps. 46 to 50, Rs. 12 to 14 and along the upper terraces of the McLeod, Pembina, and North Saskatchewan Rivers. In the east extensive gravel deposits are found along the meltwater channel system in the Onoway - Heatherdown - Duffield area. Near Heatherdown the terraces contain quartzite gravel reworked from the preglacial Onoway Channel. Near Duffield, late-stage erosion left only a discontinuous lag gravel, and in places exposed bedrock. Excavation into one esker located in Tp. 47, R. 13 has exposed 10 m of sand and gravel and in another (Tp. 53, R. 3), 6 m of sand beneath a till veneer. A kame moraine in Tp. 55, R. 6 contains discontinuous bodies of poorly sorted fluvial sediments and till.

GLACIOLACUSTRINE DEPOSITS

Approximately 40 percent of the area is covered by sediments deposited in meltwater lakes ponded against the northeast retreating glacier. In the west half these deposits, mostly well-bedded silts and clays, form a thin to discontinuous drape on the highlands and a thicker cover in the valleys. Some of the thickest sediment is massive clay deposited over submerged ice in the Mayerthorpe area. Later melting of this buried ice produced the present-day hummocky terrain.

In the east a pitted delta (unit sLGp) was formed by streams flowing southeast off the glacier and burying stagnant ice. This ice later melted to produce the pits with the deepest situated in the northwest adjacent to the glacier-delta contact. This unit grades into generally finer textured and thinner glaciolacustrine sediment (units mLG, sLG, uLG).

EOLIAN DEPOSITS

Eolian deposits in the map area consist mainly of U-shaped sand dunes located on the south-east margins of major meltwater channels. All dunes are presently inactive and commonly organic deposits occupy the inter-dune areas. Individual dunes attain a height of 15 m in Tp. 47 and 56, R. 12 to 13. The deltaic deposits furnished sediment for a small dune area (Tp. 50, R. 1). Loess deposits were not recognized in the study area.

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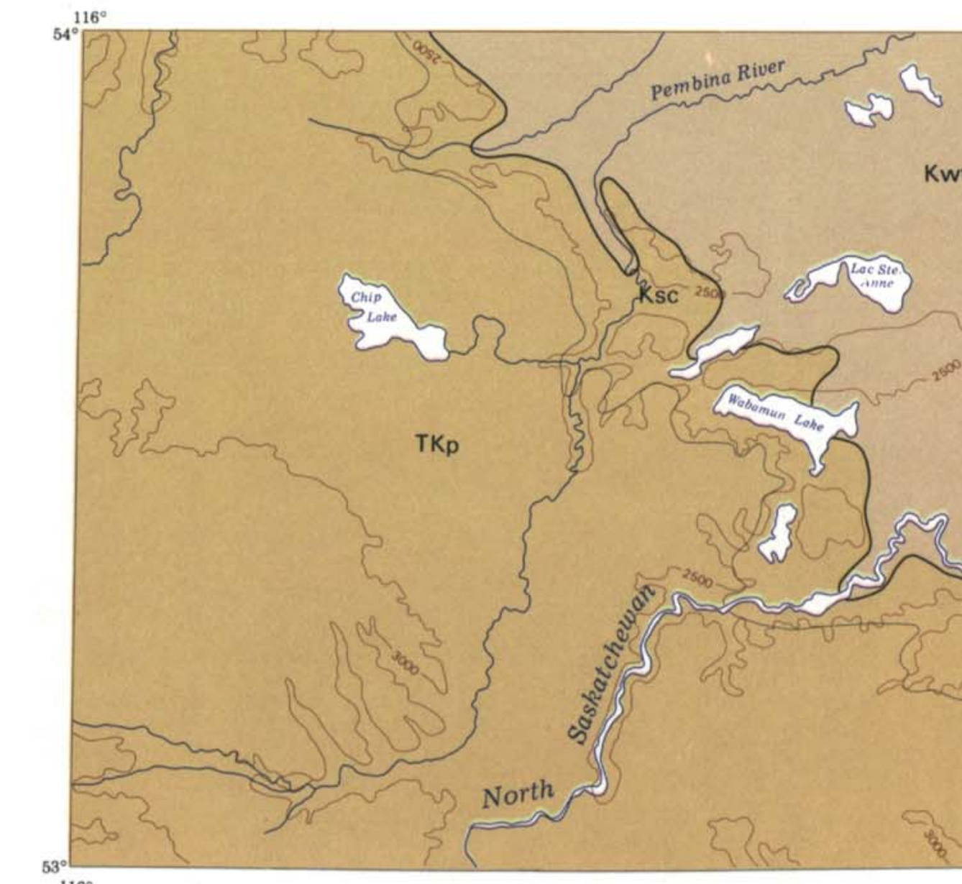
BEDROCK GEOLOGY

From R. Green, 1972



Scale 1:1,000,000

LEGEND

TERTIARY AND CRETACEOUS

TKp — PASKAPOO FORMATION: sandstone, siltstone and mudstone; minor conglomerate; Scollard Member (Ksc): sandstone; bentonitic mudstone; thick coal beds

CRETACEOUS

WHITEMUD AND BATTLE FORMATIONS: white-weathering, bentonitic sandstone; clay and silty clay (Whitemud Formation)-purplish black, mauve-weathering, bentonitic mudstone (Battle Formation)

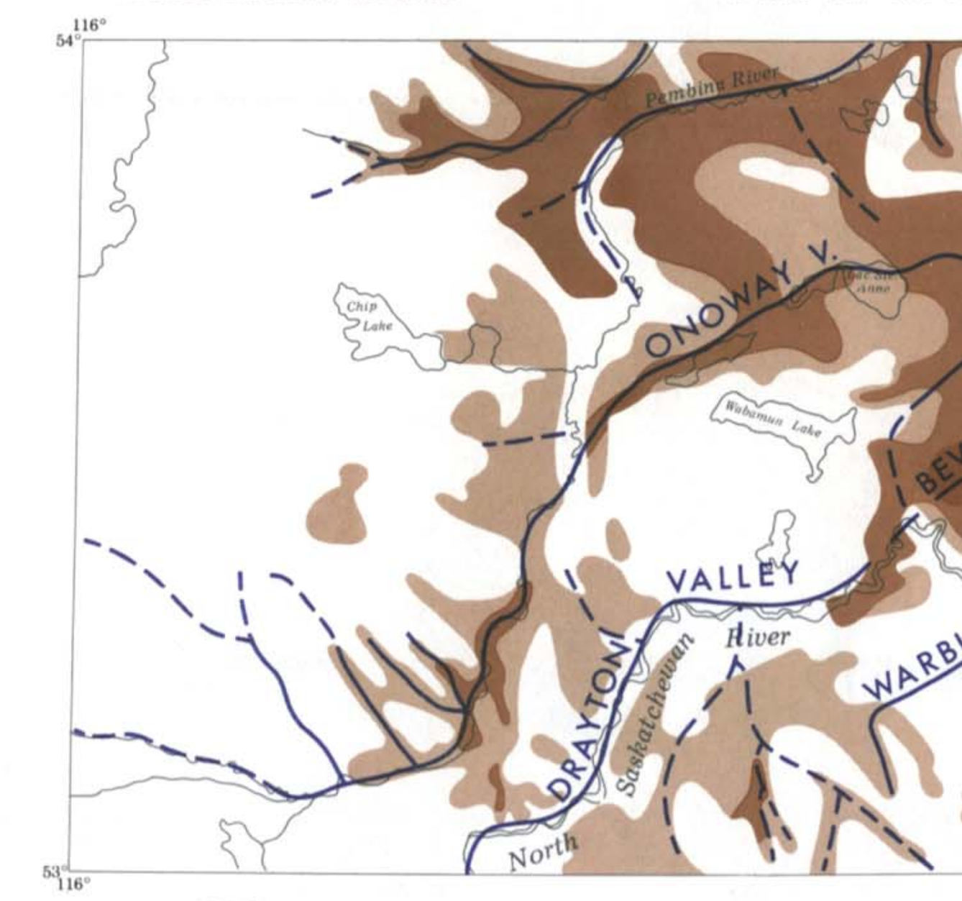
Kwt — WAPITI FORMATION: gray sandstone; mudstone and bentonite; scattered coal beds

Geological boundary ....

Surface contour (contour interval 500 feet) 2500

THALWEGS AND DRIFT THICKNESS

Modified from V.A. Carlson, 1970

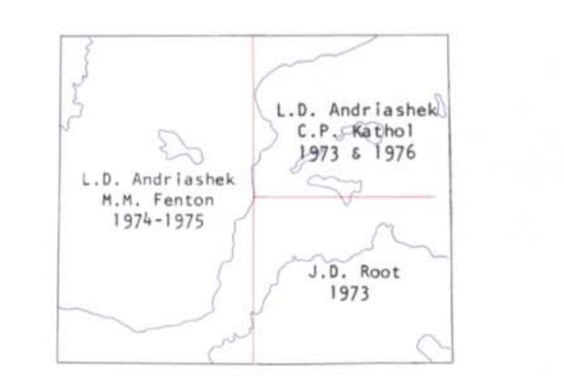


LEGEND

Scale 1:1,000,000

Thickness of drift in metres

- less than 15
- >15 to 30
- >30 to 60
- >60 to 90



MAPPING COVERAGE

KEY MAP