RESEARCH COUNCIL OF ALBERTA

Preliminary Report 56-2

GLACIAL GEOLOGY
Castor District, Alberta

by

C. P. GRAVENOR

Price 50 Cents

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C.P. Gravenor

Research Council of Alberta
University of Alberta
Edmonton, Alberta
1956

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FIGURE AND MAP

GLACIAL GEOLOGY OF CASTOR DISTRICT, ALBERTA

INTRODUCTION

General Statement

This presentation of results of a survey of the surficial deposits of the Castor district forms part of a program to map the glacial geology of east-central Alberta.

The Castor district lies within the Torlea flats which is a north-south belt of relatively featureless ground moraine in east-central Alberta. Gently dipping Upper Cretaceous rocks are close to the surface over much of the Torlea flats, and in the Castor district bedrock is exposed in valley walls over much of the southern part of the district and the northwestern part of the district.

The northern part of the Castor district is made up of a relatively flat and featureless till plain. In the southern part of the district the surface till has been largely removed by the action of glacial waters spilling toward the east and southeast out of the Sullivan Lake basin. No evidence of the direction of glacial advance has been found in this district.

Location of District

The district mapped is located in east-central Alberta (Fig. 1) and is bounded on the east by longitude 111°35' and on the west by longitude 112°00; the northern limit is marked by latitude 52°15' and the southern limit by latitude 52°00. The total area of the district comprises about 315 square

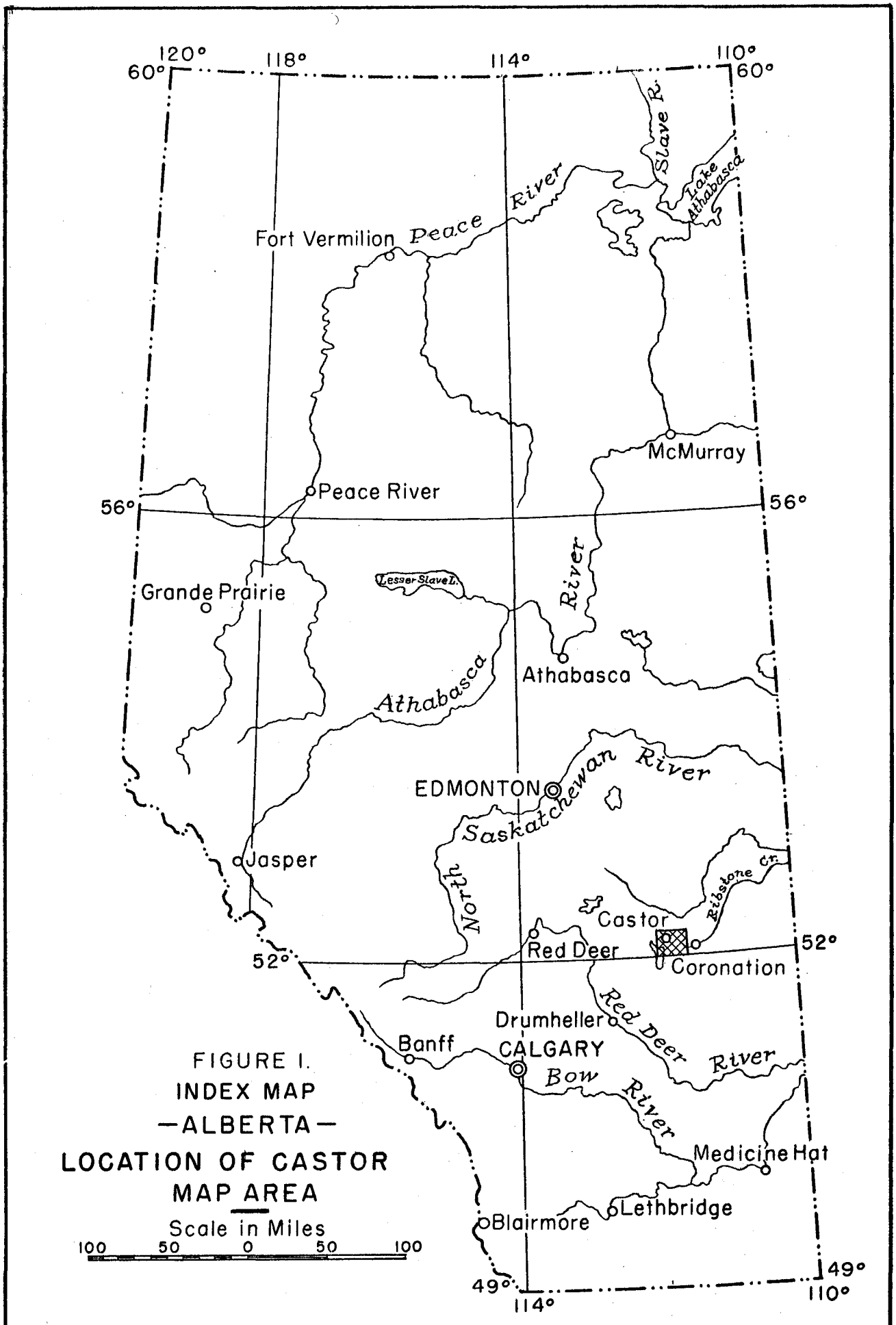

FIGURE I.
INDEX MAP
—ALBERTA—
LOCATION OF CASTOR
MAP AREA

Scale in Miles
100 50 0 50 100

miles. As the district lies west of the 4th Meridian, all locations given in this report will have that interpretation.

Previous Work

Previous glacial geology studies in this portion of Alberta have been of a very general nature and dealt mainly with the morainic systems which lie to the east and west of the Castor district--the Viking and Buffalo Lake moraines respectively. The first mention of the Torlea flats -- an area of flat ground moraine which lies between these two moraines -- was made by Warren (1937).

Wyatt, Newton, Bowser and Odynsky (1938) mapped the soils of the Coronation district on a scale of 3 miles to 1 inch. The soils classification used by them was a number system which has since been superseded by a more flexible nomenclature. J.A. Allan wrote an appendix to that report and presented an outline of the bedrock geology and the water supply and origin of the surficial deposits.

Field Work

River sections and road cuts afforded a great deal of information, but most of the data was obtained through hand-auger borings and shallow diggings. A power-driven 6-inch auger provided a great deal of information on the stratigraphic sequence and depth of drift in upland areas. This drill is capable of drilling to a depth of 85 feet, and can drill a 55-foot hole in about one hour.

Some contamination of the auger cuttings results from caving and side wall contamination, but in general quite accurate logs can be obtained by exercising a certain amount of care. Little difficulty is encountered in drilling through most drift materials and bedrock, but coarse gravels inhibit the use of this drill.

Acknowledgments

The writer is indebted to Dr. P.S. Warren of the University of Alberta for his helpful suggestions on the geology of this region. Excellent field assistance was provided by Mr. O. Erdos. Mr. S.J. Groot, draftsman-compiler for the Research Council of Alberta, prepared the accompanying map and figures.

PHYSIOGRAPHY

General Statement

The Castor district lies within the Torlea flats, which is a broad north-south belt of relatively flat ground moraine in east-central Alberta. This belt of ground moraine is bounded on the east by the Viking moraine and on the west by the Buffalo Lake moraine; it is about 200 miles in length and from 25 to 50 miles in width. In the Castor-Coronation district it is about 50 miles in width.

In the southern part of the Castor district the thin cover of ground moraine over bedrock has been largely removed by the action of glacial spillwaters moving through the Sullivan Lake basin. Although it is probable that not all of this spillway was used at any one time, nevertheless its width--up to 10 miles--would suggest that enormous quantities of water must have moved through the Sullivan Lake basin. East and south of the Castor district the spillway fans out into large areas of sand which undoubtedly represent, in part, material which was eroded from the Castor area.

The till plain found in the northern part of the Castor district is relatively featureless. It is broken only by minor forms such as small kames, crevasse fillings, local lake basins, and erosion features. A bedrock escarpment, which has been partly exhumed by post-glacial erosion, lies a few miles east and northeast of Castor and forms one of the most prominent topographic

features of the district.

The Sullivan Lake Spillway

During deglaciation of the Castor district and districts to the west of Castor, glacial meltwaters collected in the Sullivan Lake basin. When these meltwaters reached an altitude of about 2,700 feet they spilled over the drainage divide which exists about 2 to 3 miles east of Sullivan lake, and moved in an easterly and southeasterly direction. Smaller amounts of water were added to the spillway from ice melting in the Castor district, for example, from the small lake basin which occurs in the southwest corner of Tp. 37, R 13.

The sands and fine gravels which are found on the east side of Sullivan lake and west of the drainage divide are cross-bedded and consequently were deposited by current action. This would suggest that the glacial waters in the Sullivan Lake basin were actively moving, and that the Sullivan Lake basin can be considered part of the spillway. The glacial waters which passed over the drainage divide and spilled to the east were apparently not so deep, and hence had a much higher velocity and much greater erosive power, with the result that erosion predominated over deposition.

The topography of the sand east of Sullivan lake is relatively flat, with the exception of a few sand-bar ridges which trend in a southeasterly direction. No evidence of any secondary wind-dune morphology has been noted, but several small irregular hummocks of sand may well be the result of wind action.

East of the drainage divide the waters in the spillway apparently flowed in a braided pattern and removed much of the ground moraine, exposing large flat areas of Edmonton sandstone. In areas where the current action was not quite so severe, till and bedrock islands remain. Sands and gravels associated with these till islands were deposited in relatively quiet water zones of the spillway. As is indicated in Appendix A, these latter sands and gravels are suitable for road construction purposes whereas the deposits of sand and fine gravel on the east side of Sullivan lake and west of the drainage divide are unsuitable.

Till Plain

The northern part of the Castor district is primarily a till plain. For the most part the till is thin, generally less than 25 feet in thickness, most of the topography is regulated by the underlying Cretaceous bedrock. In general the topography on the till plain is gently undulating, and many of the sloughs which dot the plain are shallow kettles.

In places where the ground moraine is less than about 8 feet in thickness, kettles are absent and the surface of the ground moraine is quite flat. Such areas exist to the west and northwest of Castor and on the west side of the peninsula in Sullivan lake. These areas of thin till over bedrock can be readily delineated on air photographs by their flatness and lack of kettles.

In many places where the ground moraine is quite thin, recent stream erosion has breached the thin till cover and exposed the underlying Cretaceous

bedrock. The resultant erosion topography is of a badland type developed in the Edmonton sandstones. Once the till cover has been breached by stream action the valley walls appear to widen by parallel scarp retreat, leaving a floor of thin alluvium over bedrock which is a minor pediment. As this variety of erosion is very prominent in eastern Alberta, it should have further study -- perhaps of the type recently carried out on the Perth-Amboy Badlands of New Jersey (Schumm, 1956).

If the land surface has any significant slope, the badland type of erosion proceeds quite rapidly. East of Castor a preglacial escarpment which trends in a northwesterly direction is now being exhumed by this type of erosion. Other areas which are being eroded are found northwest of Castor and on the east side of the peninsula in Sullivan lake.

In the northwest corner of Tp. 37, R. 12, there is a broad shallow northwesterly trending valley which has a thin cover of alluvial materials over bedrock and in some places has till over bedrock. This valley is closed on the north and south ends; it appears to have been formed prior to the last glaciation but was used briefly by glacial meltwater during deglaciation.

Other features found on the till plain include small patches of outwash, two crevasse fillings, small kames, and small lacustrine plains. The outwash displays a subdued appearance and rarely rises 20 feet above the surrounding ground moraine. The crevasse fillings are about 1/4 mile in length, 150 feet in width, and from 15 to 25 feet in height.

Glacial History

Drill holes, road cuts, valley walls, etc., show the presence of only one till overlying bedrock in the Castor district. As there is evidence of multiple glaciation at many other points in Alberta, the presence of only one till in the Castor district would suggest that the last ice to cover the district removed previously deposited drift. No evidence of the direction of glaciation has been found in the Castor district. However, the general direction suggested from indicators (Gravenor, 1955A) and flutings in neighboring areas indicate south to southwesterly ice-movement directions.

No evidence of moraines which would indicate halts during deglaciation has been found in the Castor district. A thin layer of sand found above the till and bedrock in part of this area suggests that the glacier retreated mainly by stagnation (Gravenor, 1955, pp. 26-27).

After the ice had moved back to the north and east of the Castor district, meltwaters ran off through spillways -- for example, the Sullivan Lake spillway -- or collected in minor lake basins such as those southeast and southwest of Castor. Deposition in these small lake basins has continued up to the present time, and it is quite difficult to assign many of these slough-type deposits to the Pleistocene or Recent.

GLACIAL MATERIALS

General Statement

Ground moraine is the most abundant of glacial materials found in the area, followed by spillway deposits of various types, lacustrine deposits, outwash, and kames.

Ground Moraine

The ground moraine of the Castor district is mainly composed of a brown to grey compact clayey till which occasionally contains lenses of stratified materials. The surface till, to a depth varying from 10 to 20 feet, is usually brown in color, but below this depth it is grey in color. This color change is generally gradual but sometimes abrupt, and marks a change from an oxidizing to a reducing environment.

The clay fraction of the till -- representing 15 to 25 per cent of the total till -- contains large quantities of the mineral montmorillonite. This makes the till quite plastic when wet, and hence local roads are almost impassable after prolonged rain. The montmorillonite has been derived largely from the underlying Edmonton sandstones which are bentonitic. Locally the till becomes sandy or silty, which usually reflects a change in bedrock.

Coal fragments are common in the till and have been derived from the underlying Cretaceous coal seams. Chert and quartzite fragments have been derived largely from Tertiary gravels and igneous and metamorphic rocks from the Precambrian Shield.

Locally the ground moraine is covered with a thin layer of glacial sand. As discussed by Gravenor (1955, pp. 26-27) this sand probably represents superglacial debris let down from a stagnant ice surface. Care should be taken, however, not to confuse this sand with a sandy layer developed through soil-forming processes or from wind-blown sand. In general it can be distinguished from the former by its depth (where the sand lies below the "B" soil horizon) and from the latter by lenses of pebbles within the sand which could not be moved by wind. It should also be stressed that this sand is not glacial or Recent alluvium, as it is found on upland tracts and is not associated with spillways or Recent river action.

Crevasse Fillings

The crevasse fillings found in this area are composed mainly of very poorly sorted sand, gravel and till. In some respects they are similar to the ridges described by Bayrock (1955, p.12) for which he used the term "ice-block ridges". The ridges found in the Castor district were probably formed in crevasses during the late phases of stagnation of the last ice, the material in the crevasses being partially water-sorted, but the accumulation appears to be due mainly to slumping of debris into the crevasses from the neighboring ice. Thus they differ from true crevasse fillings which are formed primarily of water-sorted materials.

Kames

Except for the kame deposit located in Secs. 7 and 8, Tp. 36, R. 14,

which is quite sandy, the kames of the Castor district are made up primarily of medium-sized gravel and sand. Since only small amounts of till have been found in the kame deposits it will not hamper their use for construction purposes. The sorting of the kame material is rather good for this type of glacial deposit.

Outwash

Outwash found in this district is quite sandy with local lenses of gravel, and generally forms only a thin layer over till. Sorting is rather poor, and because of the sandy nature of the material no outwash is being used for commercial gravels in the Castor district at this time. The outwash is similar in many respects to the thin layer of sand found on the ground moraine except that the outwash is thicker, contains more gravel, and the hummocky topography is that of the outwash and not just a reflection of the underlying till.

Spillway Deposits

Spillway deposits are of two types: (a)those which are made up of thick deposits of sand, and sand and gravel, overlying till or bedrock, and (b) very thin deposits of sand and gravel overlying bedrock.

The spillway deposits which are found on the east side of Sullivan lake are quite sandy, and were probably deposited in rather deep slow-moving water. The stratigraphic sequence in this sandy area is made up of from 5 to 15 feet of coarse surface sand containing a few pebbles. Below this depth the sand usually rests on a thin layer of grey clayey till, which in turn overlies bedrock. In some

instances the till is missing and the sand directly overlies Edmonton sandstones and shales.

In the south-central and southeastern portion of the Castor district the spillway deposits are mainly confined to a very thin layer -- zero to 1 foot -- of alluvial sand and gravel over bedrock. At many places in this belt bedrock is exposed at the surface, while at other locations thin patches of till -- 1 to 3 feet in thickness -- remain as erosion remnants on the bedrock; thin alluvial sands and gravels may or may not cover these till remnants. Thicker sands and gravels are found locally in this part of the spillway and are generally associated with the till islands. These latter sands and gravels are only moderately well sorted and are generally less than 15 feet in depth overlying till or bedrock. In some places the gravels are quite coarse -- boulders up to 1-1/2 feet in diameter -- which indicates that the waters were very fast-flowing and probably shallow in this region. Many of these gravel deposits are used for construction purposes and they represent the largest reserves of gravel in the Castor-Coronation district.

Lacustrine Deposits

Those deposits mapped as glacio-lacustrine are confined to two areas southeast and southwest of Castor. The deposits consist of rudely stratified sands, silts and clays; they are quite thin and overlie till. Deposition in these lake basins has continued into Recent time and is represented by a thin layer of organic muds at the surface. It is usually rather difficult to place these lake deposits as Pleistocene or Recent.

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APPENDIX A

GRAVEL DEPOSITS

The materials shown on the map as "outwash" are usually unsuitable for construction purposes. "Kame" sands and gravels are from poor to good in quality, limited in extent , but are usable. Spillway gravels are the most extensive of the gravel deposits in the area but are usually thin, overlying till or bedrock. The sorting of these spillway gravels varies considerably, and most deposits are quite sandy. Ironstone nodules, chert and coal fragments are found in all of the gravels and are quite numerous in most spillway deposits.

Location	Extent of gravel	Description of gravel
Lsd. 1, Sec . 29, Tp. 35, R. 14.	Quite extensive. Only a small portion of the gravel has been used. Occurs as a flat-lying deposit which slopes to the south towards Sullivan lake.	Spillway deposit. Gravel is moderately sorted and rounded. Contains fragments of coal, ironstone nodules and decayed igneous and metamorphic boulders.
Lsd. 13, Sec. 23, Tp. 36, R. 13.	Limited in extent. Gravel is mainly confined to the top of hill and is thin, overlying till or bedrock.	Spillway deposit. Most of the gravel is bouldery, and sorting is only fair.
Lsd. 4 Sec. 36, Tp. 35, R. 13.	Approximately 5-10 acres of gravel in this location. Deposit is about 10 feet thick on the southern end and thins to the north.	Spillway deposit. Quality of gravel is rather poor. Large boulders (up to 1-1/2 feet in diameter), ironstone nodules and coal are abundant.
Lsd. 1, Sec. 6, Tp. 36, R. 12	Limited in extent; only suitable for local use.	Spillway deposit. Gravel is poorly sorted and contains abundant ironstone nodules.

Location	Extent of gravel	Description of gravel
Lsd. 5, Sec. 4, Tp. 36, R. 13	Limited in extent. Gravel is about 10 feet in depth.	Spillway deposit. Gravel is quite sandy and contains ironstone nodules and coal.
Lsd. 12, Sec. 8, Tp. 36, R. 12	Fairly extensive deposit, with thickness of 6 to 10 feet.	Spillway deposit. Well-sorted medium-sized gravel. Contains small amounts of coal and ironstone nodules.
Lsd. 8, Sec. 8, Tp. 36, R. 12.	There is about 1/4 mile of gravel exposed in the ditches along this road. Thickness not known.	Spillway deposit.
Lsd. 12, Sec. 17, Tp. 36, R. 12 and Lsd. 1, Sec. 24, Tp. 36, R. 13.	The two gravel pits are located in a very extensive area of sand and gravel.	Spillway deposit. Much of the gravel is sandy and moderately sorted. Contains ironstone nodules and coal fragments.
Lsd. 2, Sec. 25, Tp. 37, R. 14	Very limited deposit. Small pit has been abandoned.	Outwash deposit. Material is quite sandy.
Lsd. 16, Sec. 7, Tp. 36, R. 14.	Extensive deposit.	Kame deposit. Very sandy material but it is possible that good gravels could be located in this general area.
Lsd. 10, Sec. 23, Tp. 36, R. 12.	Extensive deposit. There is a 10-foot face of gravel exposed in a pit, but it is quite possible that thicknesses up to 30 feet may exist north of the pit in the central part of the deposit.	Kame deposit. Gravel is moderately well-sorted and rounded. No inclusions of till were noted. The gravel is of a high quality for a kame deposit.
Lsd. 1, Sec. 3, Tp. 38, R. 12.	Limited in extent. Very shallow (about 3 feet of gravel seen). May be greater thicknesses of gravel in the hill to the north of the pit.	Kame deposit. Gravel is poorly sorted, medium-sized and very sandy.

APPENDIX B

DRILL HOLES

Drill hole No.	Location	Depth, feet	Description of material
1	S.W. corner Sec. 28, Tp. 37, R. 14	0 - 14	Brown stony till.
		14 - 21	Grey clayey till; few stones.
		21 - 25	Bedrock, Edmonton formation; grey-green medium-grained sandstone.
2	Center of Sec. 20, Tp. 37, R. 14	0 - 20	Brown sandy till; contains a few thin sand lenses; water table at 19 feet.
		20 - 25	Bedrock, Edmonton formation; grey-green medium-grained sandstone.
3	Center of Sec. 28, Tp. 37, R. 14	0 - 7	Light-brown silty till; contains a few lenses of interstratified silt.
		7 - 18	Brown clayey till.
		18 - 22	Bedrock, Edmonton formation; dark grey sandy siltstone.
4	N.E. corner Sec. 28, Tp. 37, R. 14	0 - 6	Light-brown silty till.
		6 - 9	Bedrock, Edmonton formation; grey sandstone containing shale layer and organic matter.
5	Center of Sec. 34, Tp. 37, R. 14	0 - 3	Light-brown silty clay.
		3 - 6	Brown sandy till.
		6 - 8	Bedrock, Edmonton formation; grey shale.
		8 - 8.5	Ironstone nodules.
		8.5 - 9	Coal.
6	N.E. corner Sec. 34, Tp. 37, R. 14	0 - 9	Brown sandy till.
		9 - 12	Bedrock, Edmonton formation; coal.
		12 - 14	Grey-green medium-grained sandstone.
7	N.E. corner Sec. 2, Tp. 38, R. 14	0 - 8	Dark brown clayey till.
		8 - 8.5	Bedrock, Edmonton formation; bentonite seam.
		8.5 - 13	Red shale.

Drill hole No.	Location	Depth, feet.	Description of material
8	N.E. corner Sec. 26, Tp. 37, R. 14	0 - 5	Light-brown silty till.
		5 - 13	Brown sandy till.
		13 - 18	Bedrock, Edmonton formation; coal.
9	S.W. corner Sec. 26, Tp. 37, R. 14	0 - 3	Brown sandy till.
		3 - 5	Bedrock, Edmonton formation; grey-green sandstone.
10	S.W. corner Sec. 22, Tp. 37, R. 14	0 - 12	Brown clayey till; high salt content.
		12 - 15	Bedrock, Edmonton formation; dark grey shale with interlayered sandstone.
11	S.W. corner Sec. 32, Tp. 37, R. 14	0 - 16	Brown sandy till.
		16 - 22	Grey sandy till; water table at 20 feet.
		22 - 25	Bedrock, Edmonton formation; grey sandstone with shale partings.
12	N.E. corner Sec. 32, Tp. 37, R. 14	0 - 5	Bedrock, Edmonton formation; bentonitic sandstone.
13	Center of Sec. 4, Tp. 38, R. 14	0 - 3	Bedrock, Edmonton formation; bentonitic sandstone.
14	N.E. corner Sec. 4, Tp. 38, R. 14	0 - 2.5	Brown sandy till.
		2.5 - 5	Bedrock, Edmonton formation; coal.
15	N.E. corner Lsd.14, Sec. 20, Tp. 37, R. 12	0 - 4	Light-brown silty till.
		4 - 8	Brown clayey till.
		8 - 12	Bedrock, Bearpaw formation; brown shale containing abundant gypsum crystals.
16	150 yards east of drill hole No. 15	0 - 5	Light-brown silt; contains a few stones.
		5 - ?	Gravel; impenetrable.
17	300 yards east of drill hole No. 15	0 - 8	Brown clayey till.
		8 - 12	Bedrock; Bearpaw formation; brown shale containing gypsum.
18	400 yards east of drill hole No. 15	0 - 5	Light-brown silt and clay; well stratified.
		5 - 15	Brown clayey sand; water table at 12 feet.
		15 - 20	Bedrock, Bearpaw formation; dark grey shale.

Drill hole No.	Location	Depth, feet	Description of material
19	N.E. corner Lsd. 16, Sec. 20, Tp. 37, R. 12	0 - 3	Dark grey clay.
		3 - 12	Light-brown fine sand; contains a few small stones.
		12 - 17	Light-brown silt.
		17 - 25	Grey fine sand.
		25 - 28	Brown clayey sand.
		28 - 33	Brown sandy till.
		33 - 35	Bedrock, Bearpaw formation; grey shale.
20	Lsd. 13, Sec. 21, Tp. 37, R. 12	0 - 12	Light-brown fine sand.
		12 - 26	Brown sandy clay till; more stony near bottom.
		26 - 36	Brown coarse sand; contains a few stones.
		36 - 38	Dark brown clayey till.
		38 - 45	Dark grey clayey till.
		45 - 53	Gravel.
		53 - 55	Grey till.
21	Lsd. 14, Sec. 32, Tp. 35, R. 14	0 - 18	Bedrock, Edmonton formation; grey sandstone containing shale layers.
22	Lsd. 13, Sec. 32, Tp. 35, R. 14	0 - 2	Brown, clayey till.
		2 - 8	Bedrock, Edmonton formation; brown shale.
23	N.W. corner Sec. 29, Tp. 35, R. 14	0 - 6	Light-brown silty till.
		6 - 20	Brown clayey till; contains numerous stones.
		20 - 22	Brown coarse sand.
		22 - 30	Brown clayey till.
		30 - 39	Grey clayey till.
		39 - 44	Bedrock, Edmonton formation; grey sandstone.
24	S.W. corner Lsd. 2, Sec. 6, Tp. 36, R. 14	0 - 6	Light-brown silty till.
		6 - 12	Bedrock, Edmonton formation; dark grey shale containing a few thin bentonite seams.

Drill hole No.	Location	Depth, feet	Description of material
25	N.W. corner Sec. 6, Tp. 36, R. 14	0 - 6	Dark brown clayey till; contains numerous stones.
		6 - 9	Bedrock, Edmonton formation; grey medium-grained sandstone.
26	N.E. corner Sec. 6, Tp. 36, R. 14	0 - 10	Brown clayey till.
		10 - 15	Bedrock, Edmonton formation; grey bentonitic shale.
27	N.E. corner Lsd. 8, Sec. 7, Tp. 36, R. 14	0 - 15	Brown clayey till.
		15 - 18	Bedrock, Edmonton formation; dark-grey shale.
28	N.E. corner Sec. 7, Tp. 36, R. 14	0 - 18	Sand and fine gravel (glacial); contains numerous coal fragments; water table at 10 feet.
		18 - 25	Bedrock, Edmonton formation; grey medium-grained sandstone.
29	N.E. corner Sec. 1, Tp. 36, R. 14	0 - 12	Coarse sand (glacial) containing clay layers; water table at 11 feet.
		12 - 24	Bedrock, Edmonton formation; grey medium-grained sandstone which contains some coal.
30	S.E. corner Sec. 1, Tp. 36, R. 14	0 - 8	Coarse sand (glacial); clay matrix; water table at 7 feet.
		8 - 11	Brown clayey till.
		11 - 14	Bedrock, Edmonton formation; grey medium-grained sandstone.
31	S.E. corner Sec. 36, Tp. 35, R. 14	0 - 15	Coarse sand (glacial); contains a few pebbles; water table at 8 feet.
		15 - 20	Grey clayey till.
		20 - 30	Bedrock, Edmonton formation; dark grey shale containing layers of grey medium-grained sandstone.
32	S.E. corner Sec. 25, Tp. 35, R. 14	0 - 7.5	Brown coarse sand (glacial); water table at 6 feet.
		7.5 - 11	Grey clayey till containing numerous stones.
		11 - 15	Bedrock, Edmonton formation; dark grey shale.

Drill hole No.	Location	Depth, feet	Description of material
33	S.E. corner Sec. 24, Tp. 35, R. 14	0 - 12	Very coarse sand to fine gravel (glacial); cross-bedded in nearby outcrop.
		12 - 15	Bedrock, Edmonton formation; blue-grey medium-grained sandstone.
34	S.E. corner Sec. 19, Tp. 35, R. 13	0 - 6	Coarse sand (glacial).
		6 - 8	Blue-grey clay (glacio - lacustrine).
		8 - 11	Brown clayey till containing few pebbles.
		11 - 14	Bedrock, Edmonton formation; grey sandstone with shale layers.
35	N.E. corner Lsd. 14, Sec. 20, Tp. 35, R. 13	0 - 3	Brown coarse sand (glacial).
		3 - 10	Bedrock, Edmonton formation; grey shale with ironstone nodules.
36	N.E. corner Sec. 19, Tp. 35, R. 13	0 - 8	Brown very coarse sand (glacial).
		8 - 15	Grey-blue dense clay; probably bedrock.
		15 - 18	Bedrock, Edmonton formation; grey medium-grained sandstone.
37	N.E. corner Sec. 31, Tp. 35, R. 13	0 - 2.5	Brown medium-grained sand (glacial).
		2.5 - 6	Brown stony till.
		6 - 7	Bedrock, Edmonton formation; grey shale.
		7 - ?	Coal.
38	N.E. corner Lsd. 13, Sec. 32, Tp. 35, R. 13	0 - 2	Brown coarse sand (glacial).
		2 - 15	Brown clayey till.
		15 - 17	Bedrock, Edmonton formation; coal.
39	S.E. corner Lsd. 9, Sec. 24, Tp. 37, R. 14	0 - 12	Brown clayey till.
		12 - 14	Coarse sand and fine gravel (glacial).
		14 - 16	Brown clayey till.
		16 - 18	Bedrock, Edmonton formation; grey medium-grained sandstone.
40	N.E. corner Lsd. 9, Sec. 18, Tp. 37, R. 13	0 - 4	Brown stony till.
		4 - 8	Bedrock, Edmonton formation; brown shale with sandy streaks.

Drill hole No.	Location	Depth, feet	Description of material
41	S.W. corner Sec. 16, Tp. 37, R. 13	0 - 12	Brown stony till.
		12 - 13	Bedrock, Edmonton formation; light-brown bentonite.
		13 - 15	Grey medium-grained sandstone.
42	N.E. corner Lsd. 8, Sec. 9, Tp. 37, R. 13	0 - 4	Light-brown silty till.
		4 - 6	Dark brown silty till.
		6 - 8	Bedrock, Edmonton formation; grey shale.
43	Lsd. 4, Sec. 11, Tp. 37, R. 13	0 - 2.5	Light-brown stony till.
		2.5 - 3.5	Coarse sand (glacial).
		3.5 - 8	Dark brown stony till.
		8 - 13	Bedrock, Edmonton formation; brown shale.
44	Lsd. 16, Sec. 2, Tp. 37, R. 13	0 - 8	Brown stony till.
		8 - 12	Bedrock, Edmonton formation; blue-grey sandstone.
45	Lsd. 5, Sec. 6, Tp. 37, R. 12	0 - 3	Brown fine sand containing a few stones.
		3 - 11	Light-brown silty till.
		11 - 14	Bedrock, Edmonton formation; grey sandstone.

RESEARCH COUNCIL OF ALBERTA

LEGEND

CENOZOIC

QUATERNARY

REGENT

10 — Alluvium and colluvium: sand, silt and clay (generally thin over bedrock)

PLEISTOCENE

GLACIO-LACUSTRINE

9 — Sand, silt and clay

GLACIO-FLUVIAL

8 — Spillway*: sand, sand and gravel (thin over bedrock; bedrock often exposed at surface)

7 — Spillway: sand, sand and gravel

6 — Outwash: sand, sand and gravel (generally thin over till)

5 — Kame: silt, sand and gravel; inclusions of till

GLACIAL

4 — Crevasse-fillings: sand and gravel; inclusions of till

3 — Ground moraine (thin over bedrock)

2 — Ground moraine-till: unsorted clay, silt, sand and boulders; some lenses of sand and gravel

MESOZOIC

CRETACEOUS

UPPER CRETACEOUS

1 — Edmonton Formation: grey bentonitic sandstone containing coal and bentonite seams

*In part 10 in age

Bedrock outcrop X

Gravel pit ..... G.P.

Geology by C.P. Gravenor

Main highway

Local road, well travelled

Local road, not well travelled

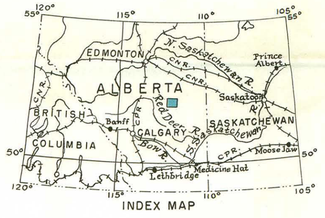
Railway

Township boundary

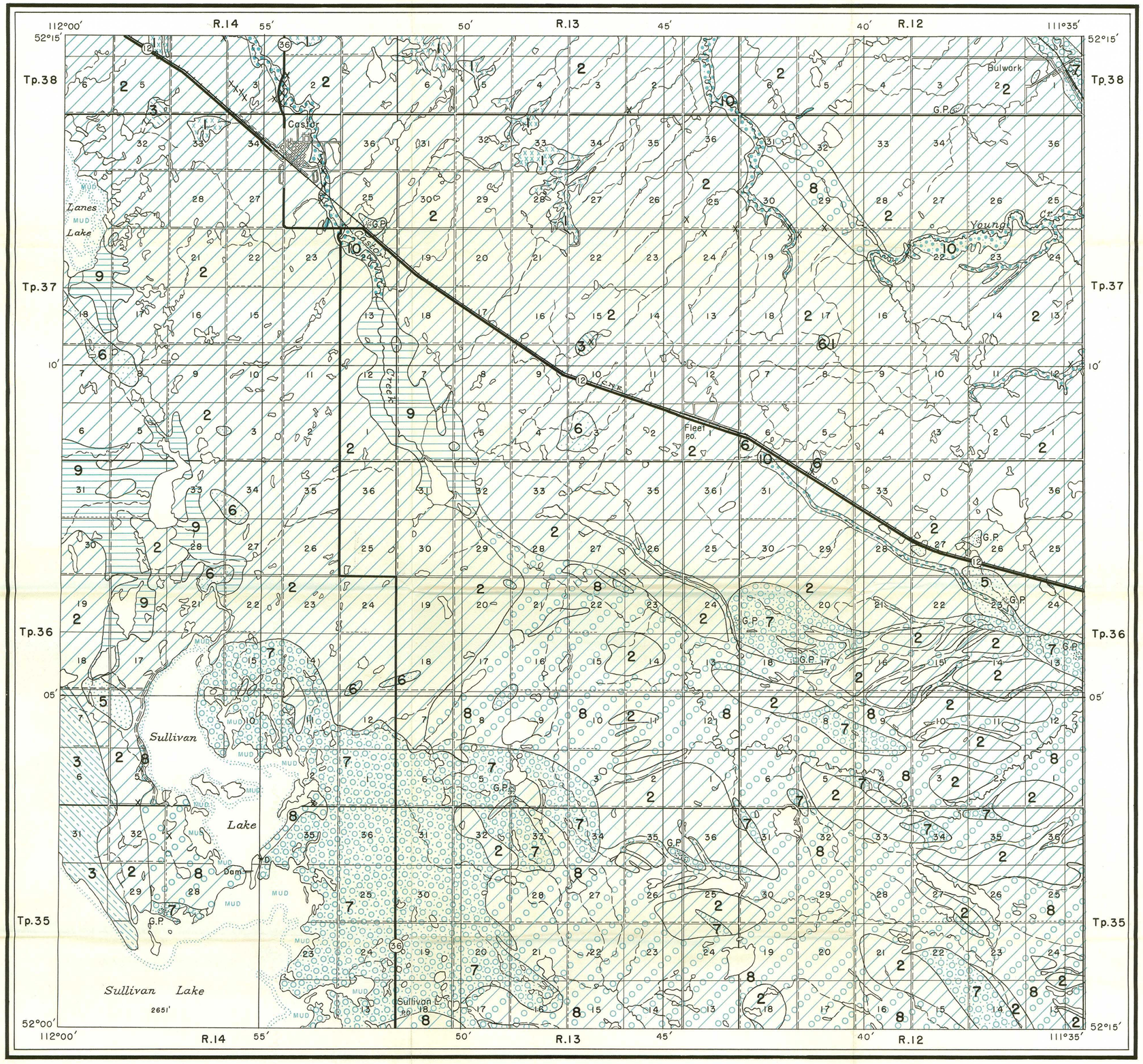
Section line

Post office ..... P.O.

Cartography taken from Department of Lands and Forests, Alberta, Aerial Survey Sheet No. 73 D/4



INDEX MAP



Map to be used in conjunction with Preliminary Report No. 56-2

PRELIMINARY MAP 56-2

GLACIAL GEOLOGY

CASTOR DISTRICT, ALBERTA

WEST OF FOURTH MERIDIAN

Scale: One Inch to One Mile = 1/63,360

1 3/4 1/2 1/4 0 1 2 3 MILES

Published in 1956