GEOMORPHOLOGY OF THE AMISK LAKE AREA, SASKATCHEWAN

by

S. C. ZOLTAI

NORTHERN FOREST RESEARCH CENTRE
INFORMATION REPORT NOR-X-16
FEBRUARY 1972

Canadian Forestry Service
Department of the Environment
5320 - 122 Street
Edmonton 70, Alberta, Canada

TABLE OF CONTENTS

GEOMORPHOLOGY OF THE AMISK LAKE AREA, SASKATCHEWAN

by

S. C. Zoltai*

ABSTRACT

The geomorphology of a 5,570 square mile area in east-central Saskatchewan was mapped. The map units are landforms and complexes, with added information on slope and parent material classes. Glacial and post-glacial events are briefly outlined.

INTRODUCTION

The geomorphology of the Amisk Lake map sheet (63L) was determined to provide basic information on the distribution of parent soil materials and slope patterns which influence the growth and distribution of forests. This study, undertaken in 1970, is the third in a series of broad reconnaissance of geomorphic features in central Saskatchewan (Zoltai, 1968; 1969).

---

* Research Scientist, Northern Forest Research Centre, Canadian Forestry Service, Department of the Environment, 5320 - 122nd Street, Edmonton 70, Alberta, Canada.

METHODS

All roads were traversed in this poorly accessible area. Further information was collected during a three day helicopter survey in inaccessible areas. Soil profiles were examined in the dominant parent materials and samples were collected. The mineral content of stony soils was estimated by counting stones in broad mineral classes. Peat landforms were probed to ascertain the presence and extent of permafrost.

The landforms were mapped on aerial photographs, as identified by their morphology, slope pattern, and inferred soil material. The texture of parent material samples was obtained by the Bouyoucos method, and the calcite-dolomite content by the intercept method (Skinner _et al_. 1959).

GLACIAL HISTORY

Surficial deposits indicate that the entire area was affected by continental glaciation during the Pleistocene epoch. The orientation of striations and drumlins, and the mineral composition of tills indicate that portions of the area were affected by ice masses approaching from different directions.

The glacially-oriented landforms and striae show the latest glacial movements only, as traces of earlier movements were removed or masked by later ice advances. Drumlins and striae show (Figure 1) that

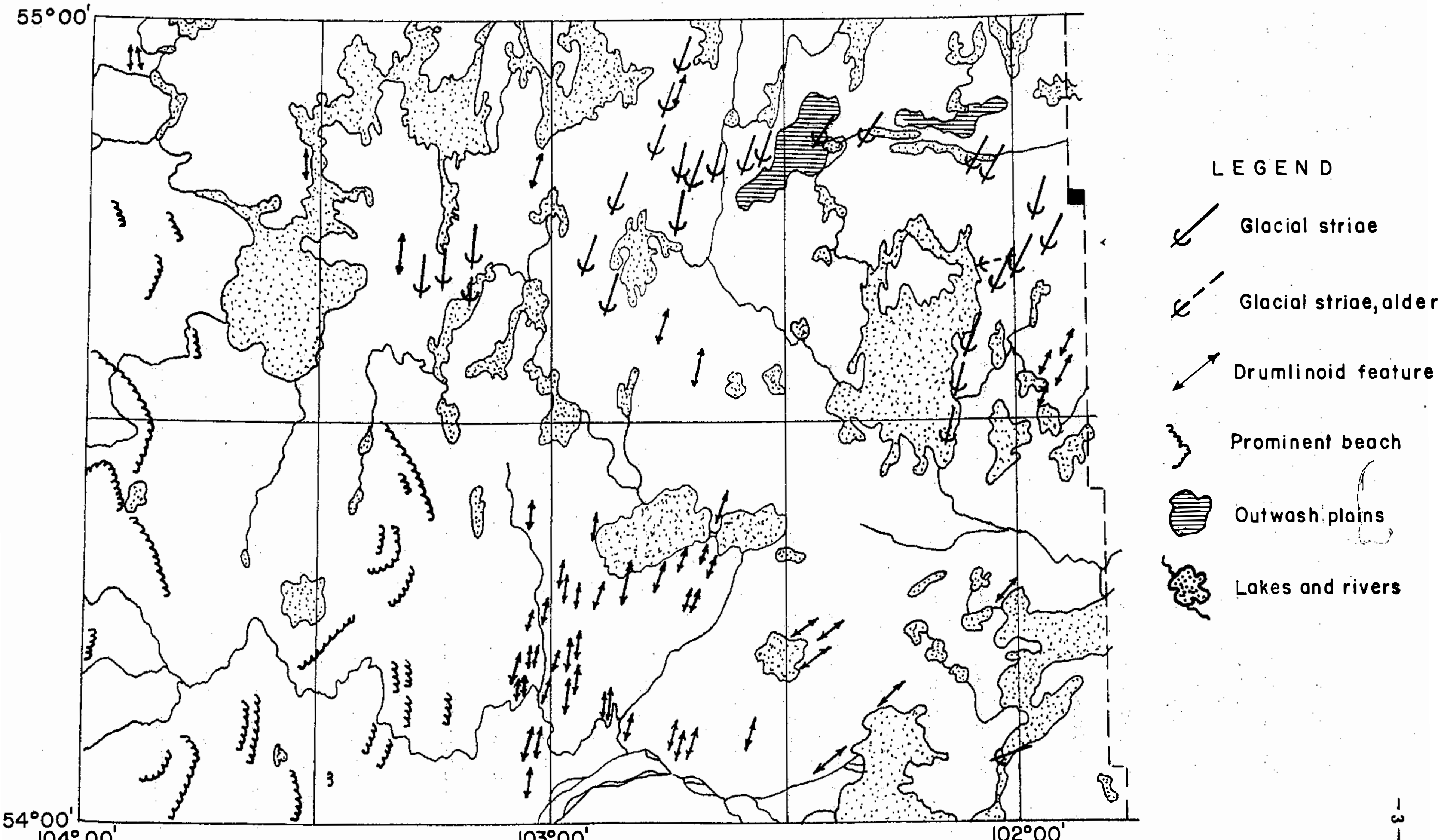

Figure 1. Glacially oriented landforms, striae and abandoned beaches.

ice reached the southeastern corner of the area from the east. At the same time another ice sheet was advancing in a southerly direction. The orientation of drumlins and striae associated with this ice mass suggest that this ice flow was deflected to a southwesterly direction by the eastern ice sheet. Crossing striae east of the mapsheet show that a small part of the area previously covered by the eastern ice mass was overridden by the northern ice mass (Figure 2).

Upon the melting of the ice a large lake occupied the ice-free areas, as evidenced by laminated and massive lacustrine deposits and abandoned beaches (Figure 1). This lake is identified as Lake Agassiz which covered extensive areas of adjoining Manitoba (Elson, 1967). A series of beaches were built by this lake within the study area, the highest being at about 1400 feet present elevation. Other strong beaches are at about the 1310 foot elevation.

Renewed glacial activity halted the retreat of glacier front in the northeastern part of the map area (Figure 2). No moraines were built, although outwash sands were deposited along the ice front, often as deltaic materials into Lake Agassiz. Upon the complete disappearance of glacier ice, the lake covered the entire area, but subsequently lowering water levels gradually exposed the former lake bed.

Post-glacial deposition of alluvial materials took place in the southeastern part of the area, along the floodplains of the Saskatchewan River. Eolian deposits were laid down near abandoned raised beaches where sandy material was available for dune formation. Elsewhere peat began to accumulate in poorly drained basins, often reaching a

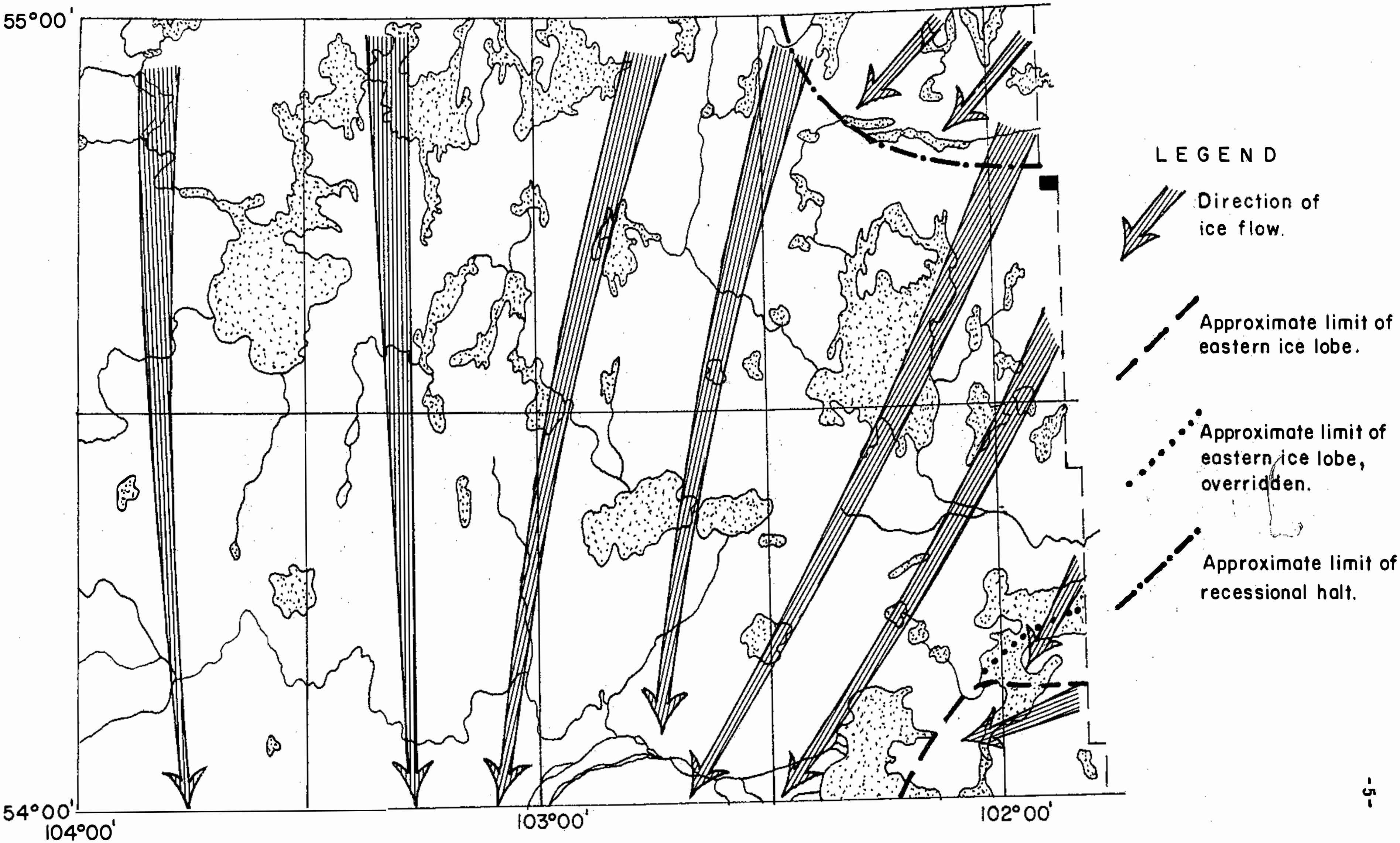

Figure 2. Approximate extent and general direction of ice movements.

thickness of 15 feet. Depressions and some shallow ponds were gradually filled with remains of sedges and grasses, and later invaded by peat-forming bog vegetation. At the present, many grassy fens are completely or partially covered by remains of plants growing in bogs, such as sphagnum moss, black spruce, and ericaceous shrubs.

LANDFORMS

1. Geologic materials

a. Bedrock

The contact between the Precambrian rocks of the Canadian Shield and Palaeozoic rocks of the Manitoba Lowland cuts diagonally across the map area (Lang, 1961), from about Oskikebuk River in the northwest to Maraiche Lake in the east.

Precambrian bedrock. Characterized by crystalline bedrock, highly resistant to weathering. Consists of intrusive and metamorphosed intrusive rocks as granite, granite gneiss, granodiorite; some volcanic rocks as andesite, basalt, and greenstones; and derived gneisses and schists (Lang, 1961).

Palaeozoic bedrock. Flat-bedded, carbonate-rich rocks that are moderately resistant to weathering. Dolomite and dolomitic limestone of Ordovician age, and Silurian dolomite characterize these formations (Lang, 1961).

b. Glacial deposits.

Till is the most widespread glacial deposit. It is usually thin to discontinuous over Precambrian bedrock and on some dolomite

Table I. Mechanical and chemical analyses of typical parent material samples

Geologic material	Sand %	Silt %	Clay %	Textural class	pH	Calcite %	Dolomite %
1. Silty sand till	79	18	3	Loamy sand	6.3	-	-
2. Moderately calcareous loamy till	55	32	13	Sandy loam	7.8	6.5	6.0
3. Extremely calcareous loamy till	59	27	14	Sandy loam	7.8	10.5	19.0
4. Fine textured lacustrine sediment	2	34	64	Clay	7.8	15.2	5.8
5. Beach deposit	96	3	1	Sand	7.2	1.0	5.5
6. Outwash sand	97	3	-	Sand	6.2	-	-

plateaus, but locally thick till may be found. Three different types of till were identified.

Silty sand till. Occurs within the Canadian Shield, being derived from crystalline bedrock. It is high in sand, very low in clay (Table I, No. 1), and contains no carbonates. Dystric, or Degraded Dystric Brunisol* soils develop on fresh to moist sites.

Moderately calcareous loamy till. Occurring in a narrow belt south of the Canadian Shield, and consists of a mixture of materials derived from Precambrian and Ordovician rocks. Its texture varies from a sandy loam to loamy sand, and contains low to moderate amounts of carbonates (Table I, No. 2). Grey Luvisol or Degraded Eutric Brunisols develop on fresh to moist sites.

Extremely calcareous loamy till. Found in the southern half of the area underlain by Palaeozoic rocks. It consists largely of dolomitic rock fragments, with little admixture of crystalline materials. It has a loamy texture (Table I, No. 3). Gray Luvisols or Degraded Eutric Brunisols develop on fresh sites.

c. Lacustrine deposits.

Lacustrine deposits are abundant only near abandoned beaches and shorelines. Fine textured sediments are restricted to elevations below 1125 feet in the west and below 1100 feet in the east.

Fine textured sediments. These materials are high in clay sized particles and contain moderate amounts of carbonates (Table I, No. 4). Generally they are massive, but in some thick deposits laminations (varves) were noted under the homogeneous clay. Gray Luvisol soils develop on fresh sites.

---

* Soil nomenclature follows "The system of soil classification for Canada", National Soil Surv. Comm., 1970.

Medium textured sediments. This material is found near raised beaches, in what was the foreshore area of the ancient lake. It consists mainly of fine sand and silt, with moderate amounts of carbonates. Gleyed Gray Luvisols are common on moist sites.

Coarse textured sediments. Occur in raised beaches and in near-shore deposits in the western part of the area. The beach deposits are pebbly to stony, but the near-shore sand deposits are generally stonefree. The texture is usually sand (Table I, No. 5). Degraded Eutric Brunisol develops on dry to fresh sites.

d. Fluvial deposits.

Outwash deposits. Its distribution is limited to locally extensive areas in the northeastern part of the study area. It consists of pebbly to stonefree sand (Table I, No. 6). Degraded Dystric Brunisols develop on dry to fresh sites.

e. Eolian deposits.

Dune sand. No active dunes were noted. The material was deposited by wind action on coarse textured lacustrine materials, and consists of stonefree medium sand. Degraded Eutric Brunisol soils develop on dry to fresh sites.

f. Alluvial deposits.

Alluvium. Extensive deposits of alluvium occur in the floodplains of the Saskatchewan River, and along some smaller rivers on a limited scale. These deposits consist of fine to medium textured materials, mixed with organic debris and humus. Sandy lenses are sometimes found within the stratified sequence. Gleyed Regosols characterize these moist to wet materials.

g. Organic deposits.

Mesic organic matter. This somewhat decomposed organic material, composed chiefly of remains of grassy plants, is found mainly in treeless fens.

Fibric organic matter. This poorly decomposed material consists of sphagnum peat and forest peat (moss and wood). Fibric organic matter usually occurs as the uppermost layer in bogs, covering mesic organic materials.

2. Form of land

Landforms occurring on the map sheet were identified on the basis of their genesis and form, and further subdivided according to their characteristic slope pattern and texture of the material. The broad relief classes are based on relative height and length of slope (Table II). Resulting divisions form the mapping units of the geomorphological map (in pocket).

Table II. Broad relief classes

Very low relief	- Essentially level area, with less than 10% of other relief classes, which are less than 25 ft. magnitude.
Low relief	- Area of long gentle slopes, or very short steep slopes. Difference in elevation is less than 75 feet.
Moderate relief	- Areas of long moderate slopes or of short steep slopes. Difference in elevation less than 200 feet.

Many landforms have no characteristic slope pattern or assume the relief of the underlying bedrock. Some landforms, however, have peculiar surface features that can be related to their mode of deposition or subsequent events. These landforms are described below.

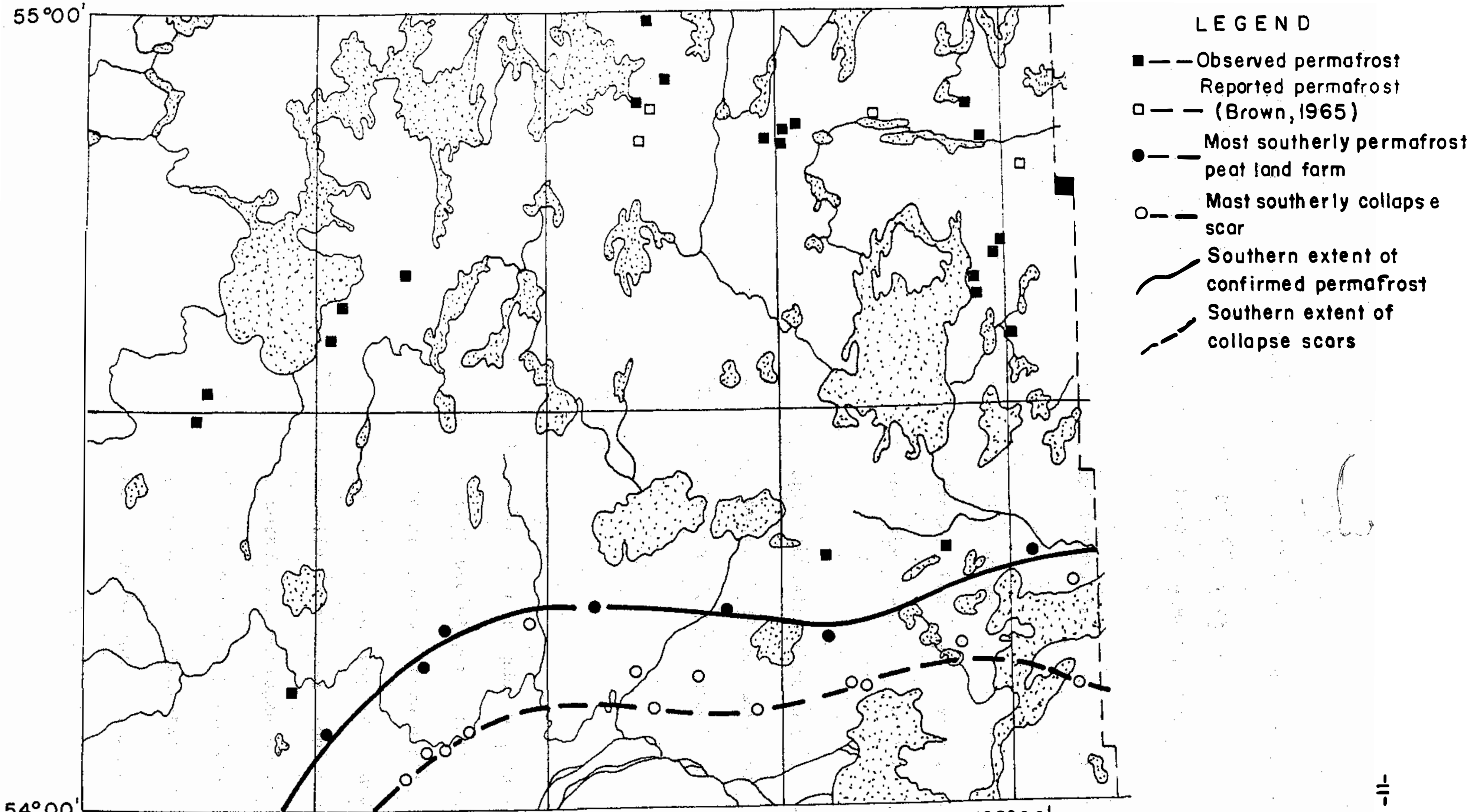

Figure 3. Permafrost features observed in the field and on aerial photos.

Knob and kettle complex ('Gmk' on map) refers to a rolling, hummocky till plain where high and low ground alternate with great frequency. Most depressions are closed basins and have poor drainage.

Flutings ('Gmf' on map) identify areas where elongated, low, broad ridges occur parallel to one another.

Wave-washed ground moraine ('Gnw' on map) identifies areas which were modified by lake erosion.

Bedrock plateau ('Rp' on map) refers to flat to gently dipping table lands of bare to thinly covered Palaeozoic bedrock. Low (up to 30 feet high) escarpments are associated with these plateaus, generally on the north to northeastern edge.

Thermokarst ('Ok' on map) occurs in organic deposits that contain perennially frozen materials. Relief is low, but with large number of knolls and depressions resulting from differential melting of permafrost.

PERMAFROST

Perennially frozen materials occur in peatlands in almost all parts of the area. The most southerly occurrence of permafrost was determined by combining field observations with air photo interpretation (Figure 3). This boundary occurs in the southern part of the map area, and is bordered by a narrow zone where no perennially frozen peat landforms (peat plateaus, palsas: Zoltai, in press) were noted, but collapse scars do occur. These collapse scars are believed to indicate that some permafrost is present now or was present in the near past, and the vegetation is still recovering from the effects of subsidence caused by the melting of the permafrost (Zoltai, in press).

REFERENCES

Brown, R. J. E. 1965. Permafrost investigations in Saskatchewan and Manitoba. Div. Bldg. Res., Nat. Res. Council Tech. Paper 193, 60 p.

Elson, J. A. 1967. Geology of Glacial Lake Agassiz. In: W. J. Mayer-Oakes, ed., "Life, Land and Water", Univ. of Manitoba Press, p. 37-95.

Lang, A. H. 1961. Geology of Carrot River, Manitoba-Saskatchewan. Geol. Surv. Canada, Map 1164A.

Skinner, S. I. M., Halstead, R. L., and Brydon, J. E. 1959. Quantitative manometric determination of calcite and dolomite in soils and limestones. Can. J. Soil Sci., 39: 197-204.

Zoltai, S. C. 1968. Geomorphology and land units of the St. Walburg area, Saskatchewan. Can. Dept. of Forestry and Rural Dev., Forestry Br., Info. Rept. MS-X-10, 8 p.

Zoltai, S. C. 1969. Geomorphology of the Waterhen River area, Saskatchewan. Can. Dept. Fisheries and Forestry, Forestry Br., Info. Rept. MS-X-19, 10 p.

Zoltai, S. C. In press. Southern limit of permafrost features in peat landforms, Manitoba and Saskatchewan. Geol. Assoc. Can., Special Paper No. 9.

Zoltai, S. C.

1972. Geomorphology of the Amisk Lake area, Saskatchewan.

Information Report NOR-X-16; 13 p.; Northern Forest Research Centre, Canadian Forestry Service, Department of the Environment, Edmonton 70, Alberta, Canada.

Zoltai, S. C.

1972. Geomorphology of the Amisk Lake area, Saskatchewan.

Information Report NOR-X-16; 13 p.; Northern Forest Research Centre, Canadian Forestry Service, Department of the Environment, Edmonton 70, Alberta, Canada.

Copies of this publication (if still in stock) may be obtained from:

Information Officer,
Northern Forest Research Centre,
Canadian Forestry Service,
Department of the Environment,
5320 - 122 Street,
Edmonton 70, Alberta, Canada.