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AIR PHOTOGRAPH INTERPRETATION OF A PART OF

CLEAR HILLS AREA, ALBERTA

LEGEND (for figure #1)

For maps (1) 84D/10, (2) 84D/10W, (3) 84D/14E
(4) 84D/15W, (5) 84D/15E

A — Slump and landslide

B — Recent alluvial

C — Bedrock outcrop

D — Steep erosional escarpment

E — Glacial outwash gravel

F — Glacial spillway

G — Sloping upland

H — Upland covered with hummocky moraine

I — Level upland

J — Hummocky moraine

K — Ground moraine

L — Geological boundary

N.B. Legend to the maps to be used only in conjunction with the accompanying report.

AIR PHOTOGRAPH INTERPRETATION OF A PART OF

CLEAR HILLS AREA, ALBERTA

INTRODUCTION

The air photograph interpretation was performed in order to outline and determine surficial deposits and their distribution of an area comprising parts of the following National Topographic Survey Sheets: 84D/10, 84D/14 and 84D/15. All the results are shown in maps to a scale of 1:50,000 except the eastern half of Sheet 84D/10 which is to a scale of one inch to one mile.

Most of the depressions in the area are covered by shallow muskeg of sedge bog type (wet) and sphagnum moss type (dry-). The latter supports sporadic permafrost throughout the year. Muskeg was not mapped. Although it is shallow, usually ranging from 2 to 5 feet, some large muskeg areas may have up to 10 feet of organic material.

Other materials such as slope wash alluvial fans, and recent lacustrine deposits were also not mapped as they form only shallow deposits of limited areal extent.

Glacio-lacustrine deposits are present over some ground moraine in the lowlands. They are usually shallow, about 5 feet in thickness. These sediments were also not delineated as they cannot be determined from air photographs.

GEOLOGICAL SETTING

As this study is primarily concerned with surficial deposits, bedrock stratigraphy will not be discussed. It will only suffice to say that bedrock is made of marine bentonitic shales and sandstones of Upper Cretaceous age.

During the Tertiary time, after the uplift of the terraine, erosion attacked the soft, unconsolidated bedrock. Throughout this time large rivers originating in the Canadian Rocky Mountains were criss-crossing the area from the Southwest to the Northeast carrying large quantities of quartzose gravels. Later, when these gravels were deposited, they protected these areas from further erosion, thus originated the Clear Hills. They form an erosion remnant due to the fact of being protected by Tertiary gravels.

Nevertheless, some of this gravel was also eroded later, perhaps during the Early and Middle Pleistocene, covering some of the slopes of the Clear Hills with a shallow reworked gravel up to 5 feet in thickness.

During the Pleistocene, the area was covered by a continental glacier of Keewatin origin. Although the glacier attained considerable thickness, up to one mile, its effects on the gross topography of the hills were slight. Glacial erosion did not remove the cap gravels and in many instances also the reworked gravels mantling the slopes.

No contortions of the bedrock by the glacier were recognized on the photographs.

TERTIARY GRAVELS

Tertiary gravels are believed to underly glacial deposits of most of the area shown on the maps as "level upland" and "upland covered with hummocky moraine". Further it is expected to find some of the gravel also under hummocky moraine areas in the upland in the Southeastern portion of sheet 84D/15E and Northeastern portion of sheet 84D/10E.

The gravel is composed of mainly quartzite pebbles and boulders from 2 inches to 6 inches in diameter. Sand horizons should be found in the gravels, but not too frequently. In thickness this gravel should range from 10 to 50 feet, the thicker sections to be expected in large areas of level upland.

Reworked gravel has the same composition as the original Tertiary gravel except it should have relatively more sand. In thickness the reworked gravel should be from 5 to 10 feet. The thicker sections of this gravel are expected to be found on gently sloping upland. The steepest parts of the sloping upland should be without this gravel. It is also expected that the reworked gravel does not form a continuous cover but is absent from many areas indicated on the map as sloping upland.

In drilling, thick sections of Tertiary gravel may present some problems, whereas the reworked gravel should not propose any difficulties.

GROUND MORAINE

Ground moraine is composed of till. It should be mentioned here again that glacio-lacustrine deposits of relatively shallow thickness, about 5 feet, should be present over ground moraine in the lowlands.

The till covering the area is made of about 40 per cent of clay, 30 per cent of silt and 30 per cent of sand. Gravel forms only a small fraction of the total. Till in any one area is made of about 80 per cent of underlying local bedrock. Consequently, till overlying directly the gravels on the hills should be more sandy and stony than till in the lowlands. Till overlying shale should have consequently a large proportion of clay. These changes in mechanical composition of till should be noted as they should be markedly expressed in the Clear Hills. Clay rich till may be and has been sometimes confused with bedrock even by experienced drillers in Northern Alberta.

Ground moraine varies in thickness but generally till should be there between 10 and 20 feet thick and maybe up to 40, but only rarely.

HUMMOCKY MORAINE

Hummocky moraine is a deposit of till with accentuated surface relief. The till of hummocky moraine is the same in mechanical composition as that of the ground moraine being variable just the same.

All of the depressions of the hummocky moraine are filled with muskeg. Maximum thickness in the centers of the depressions should be about 10 feet, but close to the edges it thins out to zero.

Hummocky moraine is shown by two different symbols on the maps as "Hummocky moraine" and as "Upland covered with Hummocky moraine". The difference being only one of topographic position and as in sheet 84D/10 the two could not be separated and are shown by two different symbols on the east and west half of the sheet.

Small sand and gravel lenses are expected in the till of the hummocky moraine ranging from 5 to 10 feet in thickness.

The depth of till in hummocky moraine is variable, usually being between 50 to 80 feet.

There is a relationship between the size of hummocks and thickness of till in hummocky moraine regions, the larger the hummock the greater the till thickness. If the hummocks have a local relief of over 20 feet, up to 100 feet of till may be expected.

LEVEL UPLAND

Level upland areas are covered by ground moraine 5 to 20 feet in thickness. Under the till thick deposits of Tertiary gravels are expected. The till should be more stony and sandy in these areas. The gravels may be from 10 to 50 feet in thickness.

Level upland areas represent the original plain covered by gravel before erosion.

UPLAND COVERED WITH HUMMOCKY MORAINE

Areas outlined as "upland covered with hummocky moraine" are underlain by the Tertiary gravels. The hummocky moraine covering these areas is the same as the other hummocky moraine areas and all consideration applied under that heading apply here.

Unfortunately, not all areas of the "upland covered with hummocky moraine" could be properly outlined because the thick till cover obscurs the bedrock topograph to such an extent that it was

not possible to differentiate it from normal "hummocky moraine" areas. Consequently in sheet 84D/10 the two separate symbols come together without an attempt at differentiation (which was impossible).

SLOPING UPLAND

Sloping upland areas as shown on the maps are covered with ground moraine. Where the slopes are steep the till cover may have been reworked by colluvial action and colluvium will be found on the surface. Colluvium in this case is only reworked till with small admixture of bedrock.

Gentle sloping upland is also covered by till but colluvial action was relatively insignificant on it. Some reworked gravels may be found under the shallow till there. Till thickness on sloping upland should be about 10 feet or less.

GLACIAL SPILLWAY

Only three glacial spillways are outlined on the maps. They are small trenches cut by glacial meltwaters during the initial stages of deglaciation of the area. Three or four other similar spillways exist on the highland but they have not been outlined as they are of little consequence to this study.

The spillways are floored with shallow glacio-fluvial deposits of gravel and sand composition overlying bedrock directly.

GLACIAL OUTWASH GRAVEL

Only two very small areas of glacial outwash gravel were found. The gravel there is considered to be of economical quality.

BEDROCK OUTCROPS

Outcrops of subsurface strata seen on photography and the outcrops not being covered by vegetation have been delineated on the maps. Most of the outcrops should be in bedrock. It is possible that some of the outcrop areas might have only surficial deposits, specifically some of those in the lowlands.

RECENT ALLUVIAL

Recent alluvial materials are composed of silt, sand and clay with minor gravel. The thickness of recent alluvial deposits is on the average of about 10 feet.

SLUMP AND LANDSLIDE

Most intensive slumping is on the southtern slopes of the Clear Hills. Only minor slump areas were found in the tills.

The uppermost scarp of the slumps has undistorted original deposits. Otherwise the rest of the bulk of the slumps is composed of a heterogeneous mixture of bedrock and surficial deposits. No bedrock in original position is to be found there and any information, through drilling or surface exploration, obtained from these areas should be interpreted with extreme caution and with the above in mind.

GEOLOGICAL BOUNDARY

Geological boundaries shown on the maps have different accuracies. For example, the boundary between hummocky moraine and ground moraine is in fact a transitional boundary. Other boundaries, such as the outline of slump blocks are accurate within the thickness of the line shown on the maps.

Boundaries delineating the following deposits are very accurate:

(1) Glacial spillway
(2) Glacial outwash gravel
(3) Steep erosional escarpment
(4) Recent alluvial
(5) Slump and landslide
(6) Bedrock outcrop

The following deposits and features are transitional into each other:

(1) Ground moraine
(2) Hummocky moraine
(3) Level upland
(4) Upland covered with hummocky moraine
(5) Sloping upland

Consequently, care should be taken in consideration of surficial deposits close to their limits which are transitional into each other.

AGG011 Figure 1