CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

SHEET 82 P (East Half)

CENOZOIC

11	Alluvium; spillway and run-off channel deposits: sand, silt, minor gravel

GLACIAL

10	Alluvium; spillway and run-off channel deposits; mainly gravel and sand; 10a, early gravel phase
9	Lake deposits: sand
8	Lake deposits: silt
7	Lake deposits: clay; locally silty or varved; 7a, locally thin and eroded
6	Ice-contact deposits: 6a, kame; sand, minor gravel; 6b, esker; sand and gravel, poorly sorted; 6c, outwash; mostly sand, well sorted
5	Dead-ice plateau: till, clay, silt, sand, and gravel
4	Hummocky moraine: till, minor sand and gravel
3	Ground moraine: till, generally clayey; 3a, contains much Tertiary gravel; 3b, modified by lake or stream erosion or deposition

TERTIARY

2	Alluvium; high-level deposits: gravel and sand; mostly quartzite pebbles and cobbles

MESOZOIC AND CENOZOIC

CRETACEOUS AND TERTIARY

1	Bedrock, exposed or thinly covered; Bearpaw, Edmonton, and Paskapoo formations: sandstone, shale, coal seams

Geological boundary; (defined, approximate, assumed)

Ice-flow features; drumlins, drumlinoid ridges, flutings; individual features or groups of parallel features

Trend of minor morainal ridges; individual features or groups of parallel features

Geology by B. G. Craig, 1951, 1952

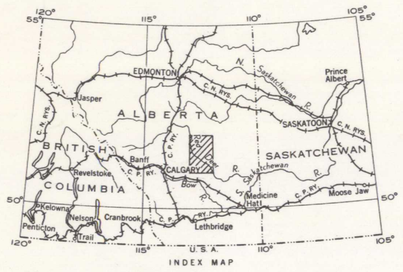
Main highway
Other roads
Township boundary
Intermittent lake and stream
Irrigation canal or ditch
Marsh
Contours (interval 200 feet)
Depression contour

Approximate magnetic declination, 21°39' East

Cartography by the Geological Cartography Unit, 1957

Air photographs covering this area may be obtained through the National Air Photographic Library, Topographical Survey, Ottawa, Ontario

In response to public demand for earlier publication, Preliminary Series maps are now being issued in this simplified form, thereby effecting a substantial saving in time. There is no loss of information, but the maps will be clearer to read if all or some of the map-units are hand-coloured.



INDEX MAP

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MAP 13-1957
SURFICIAL GEOLOGY
DRUMHELLER
(EAST HALF)
WEST OF FOURTH MERIDIAN
ALBERTA

Scale: One Inch to Four Miles = $\frac{1}{253,440}$

4 2 0 4 8 12 Miles

13-1957

DESCRIPTIVE NOTES

The alluvial sand and gravel (2) capping the Hand and Wintering Hills is thinner and more widespread than previously supposed. Previously this formation was correlated with the Cypress Hills formation of Oligocene age but it is now believed to be early Pliocene and correlates with the Flaxville gravel. The thickest section observed was 20 feet, and the maximum thickness of the deposits is less than 75 feet. It is the most important source of gravel in the area.

The ground moraine (3) is rarely more than 20 feet thick and generally no more than 10 feet.

The hummocky moraine (4), also composed of clayey till, has a relief ranging from 5 to 50 feet but averaging 25 feet. It occurs as irregular masses of mostly unoriented knobs surrounding undrained depressions. Dead-ice plateaux (5) occur as flat elevated areas within the hummocky moraine. They were formed in part by deposition of water-transported material in small ice-bound lakes.

Ice-contact deposits (6) are composed largely of stratified material deposited by meltwater in juxtaposition with glacial ice. They are not extensive but do supply minor amounts of gravel and sand. This is especially true in the case of a small unmapped kame in sec. 3, tp. 31, rge. 19, and in the area east of Byemoor.

Lake deposits (7, 8 and 9) decrease in maximum altitude from southwest to northeast due to successively lower escape routes that became available as the ice-front retreated. Lake deposits are generally thin except in the central parts of the basins. In the basin of the Red Deer River southeast of Drumheller there is a downward gradation from the surface clay to silt and in places sand. Much of the clay is thinly varved.

Alluvium (10) is found in channels carved by meltwater. These include run-off channels that were formed directly by water from melting ice and spillways that were overflow routes of glacial lakes and are now either abandoned or occupied by underfit streams. The alluvial deposits are thin or patchy. Minor amounts of gravel have been taken from them. An unmapped deposit of a similar type has been exploited on a small bench just north of Drumheller.

Post-glacial alluvium (11) is shown only along the Red Deer River but is also found in the smaller river and stream valleys. These deposits are well-stratified and commonly contain fragments of bison bone.

SEQUENCE OF EVENTS

The deposits result from at least two glacier advances. Isolated occurrences of a lower dark-coloured till are found in the valley of the Red Deer River west of Morrin and, in the valley of the Rosebud River, near Rosebud and east of Wayne. Lacustrine silts are associated with the latter deposits and both have been contorted by the subsequent glacier.

The last glacier that occupied the area moved, during its waning phases at least, in a southerly to southeasterly direction. It completely covered the area, including the Hand Hills, although glacial deposits are scarce on the higher parts and consist mostly of patches of till, glacially transported boulders, and reworked Tertiary gravel.

The glacier receded, in general, to the northeast but wasted largely by stagnation and thinning over broad areas. The first areas to become ice-free were the Hand Hills and Wintering Hills. As the ice surface became adjusted to the configuration of the land surface below it, the discharge of meltwater became concentrated in natural channels, increasing the dissipation of the ice where it was flowing, and forming glacial lakes where this flow was interrupted by natural or ice barriers. The regularity of the subconcentric stream system characteristic of the area west of the map-area had a marked effect on the northeasterly retreat of the ice-front. Meltwater collected in the basins of each of these valleys and the resulting lakes shifted downstream with a corresponding decrease in altitude as the ice-dams responsible for them melted back. Early in this process temporary escape routes through the westward continuation of the Wintering Hills to the ice-free areas to the south were active, but these channels were abandoned as the lake levels decreased. When the ice-front had retreated as far as the Red Deer River a through-flowing route was established, allowing the Drumheller area to be drained completely.

The earliest glacial lake to be formed was Lake Chancellor in the southwest corner. Thin deposits of clay that only partly mask the topography of the underlying ground moraine occupy the lake basin up to an altitude of about 3,000 feet, although the upper limit averages about 2,950 feet. Most of the edge of Lake Chancellor in the area was stagnant ice except along the bedrock area north of Standard. The outlet of Lake Chancellor was 6 miles south of Hussar where Crowfoot Creek cuts through a ridge of high land that formed the southern rim of the lake basin.

The second basin area in which glacial meltwater accumulated was the western end of the Rosebud Valley. Clay deposits occur here at an almost even altitude of 2,950 feet. Drainage was by way of the Tudor channel west of the area, and then through the Chancellor basin, which was drained completely by this time, thus allowing the channel to be over-deepened through it. West of the area the lake deposits lie at a higher altitude and this outlet was developed initially at an earlier stage than is described here. The divide in this spillway is now at an elevation of 2,909 feet.

Towards the end of this stage, but before the Tudor outlet was abandoned, the ice-front in the basin of Kneehills Creek had retreated to the vicinity of Hesketh. The high ground in tp. 28, rges. 21 and 22 prevented the water so ponded from flowing into the Rosebud basin, and a small channel was carved at a low spot at the edge of the bedrock ridge. The floor of this channel is at an elevation of about 2,950 feet. The channel was used as a spillway for only a short time until the ice-margin had retreated far enough to allow the meltwater to escape around the east end of the ridge and into the Rosebud River basin.

A similar sequence took place in the valleys of Three Hills and Ghostpine Creeks upstream from the area until all these small lakes became interconnected to form glacial Lake Drumheller.

At this stage of deglaciation, melting on the high land of the Hand Hills and Wintering Hills had divided the stagnant ice into two distinct segments that joined on the northeast side of the Hand Hills. The northern segment occupied the Drumheller lake basin in the vicinity of Morrin, Munson, and Drumheller. The southern segment occupied the low land south of the Hand Hills and Willow Creek on the east side of the Red Deer River as far south as Dorothy and the whole of the area south and east of Dorothy. Due to the general overall lowering of the ice surface the northern segment, which rested on higher land, melted back faster than the southern one and Lake Drumheller had expanded to its maximum extent while the valley of the Red Deer River was still blocked by ice. The water level rose to slightly over 2,750 feet before it spilled out along the front of the southern segment of ice. This spillway followed the ice-margin along the present course of the Red Deer River from East Coulee to Dorothy and thence southward along Crawling Valley. This phase of the lake was adjusted to the terrace level along the west side of Crawling Valley (10a), which is at an elevation slightly less than 2,750 feet. An increase in the rate of flow due to lowering of the base-level downstream caused a corresponding increase in the rate of downcutting in Crawling Valley and the deeper channel was eroded.

During the early stage of Lake Drumheller while the ice border was melting, the lower silts were deposited and were in turn overlain by clay as the lake enlarged.

The floor of Crawling Valley is now at about 2,650 feet. At this depth the spillway was able to drain Lake Drumheller, except in a few places where the upland above the valley of the Red Deer River lies below 2,650 feet. These localities were the sites of deposition of the upland silt along the Red Deer River and Kneehills Creek.

Removal of the ice barrier southeast of the entrance to Crawling Valley caused this outlet to be abandoned. Lake Drumheller was drained completely and downcutting of the present valley began. Southeast of the area on the Red Deer River another barrier to drainage brought about the formation of a lake in the vicinity of Finnegan in which sand was deposited up to an elevation of 2,550 feet.

The last remnant of the northern segment lay in the Wolf Creek and Farrell Lake, Chain Lakes, Dowling Lake basin area. This ice block obstructed the flow of water in the upper reaches of Bullpound Creek south of Watts. The lake thus formed rose to an elevation of about 3,000 feet in the vicinity of Handhills Lake. Northward retreat of the ice margin along the Bullpound Creek basin allowed the water level to drop to about 2,750 feet in the vicinity of Watts and finally allowed Bullpound Creek to flow eastward.

The last basin that was the site of lacustrine deposition was uncovered as the last remnant of ice in the area melted away through Dowling Lake. A small channel along the north sides of secs. 3 to 6, tp. 32, rge. 18 allowed the water in this basin to drain westward along the upper part of Wolf Creek into the Red Deer River via a tributary of Michichi Creek. The divide in this channel is slightly above 2,800 feet, and the fact that lake deposits are found at this elevation only at the extreme western end of the basin would indicate that the channel was very short lived.

MAP 13-1957
DRUMHELLER
ALBERTA
SHEET 82 P (East Half)