RESEARCH COUNCIL OF ALBERTA

LEGEND

RECENT

EROSIONAL FEATURES

16 Slump: *mixed glacial and bedrock materials; unstable slope*

15 Gully, creek valley: *thin colluvial cover on valley slopes; thin alluvial materials along streams*

ALLUVIAL DEPOSITS

14 Alluvial fan: *bedded silt, sand and clay; variable thickness, overlying glacial deposits*

13 Stream alluvium: *mainly sand along Athabasca River; silt, clay and sand along other streams*

AEOLIAN DEPOSITS

12 Aeolian sand, dunes: *medium-grained quartzitic sand in sheet and dune form; thick in dunes, 2 to 10 feet in sheet sand*

PLEISTOCENE

GLACIOLACUSTRINE DEPOSITS

11 Mixed: *bedded silt, clay and sand with pebbles and till-like layers; overlying till*

10 Silt and clay: *bedded silt and clay with minor sand; overlying till*

GLACIOFLUVIAL DEPOSITS

9 Meltwater channel sediment: *medium- to coarse-grained sand, overlying thin gravel and lag gravel containing many large boulders; in part, early Athabasca River sediments*

8 Outwash sand: *medium- to coarse-grained sand with pebbles and small gravel lenses; generally thin; surface level to gently undulating*

7 Outwash sand and gravel: *sand and gravel to gravel forming outwash plains; generally thick; surface level to gently undulating; some discontinuous terraces*

6 Outwash sand and gravel overridden by glacier: *fluted and drumlinized outwash of sand and gravel to gravel, with many large boulders; generally thick to very thick; topography undulating to rolling*

5 Ice-contact deposits: *sand and gravel to gravel, numerous very large boulders; rolling topography, individual hills reach heights of several hundred feet; includes kame moraine, eskers, moulin kames, crevasse fillings, and other related ice-contact glaciofluvial deposits; form end moraines of glacier advances*

GLACIAL DEPOSITS

4 Hummocky moraine: *till composed of mixed sand, silt and clay with gravel; generally thick; topography undulating to gently rolling*

3 Colluviated ground moraine: *till composed of sand, silt and clay, mantling colluviated steep slopes; partly bedded near surface; stable slope; generally thin*

2 Ground moraine: *till composed of sand, silt and clay with gravel, variable in thickness; topography level to undulating*

PRECAMBRIAN

1 Granite, gneiss and metasedimentary rocks: *outcrops form hills and knolls; generally bare with glacial deposits on the lee side of outcrops*†

Geological boundary; defined, approximate, assumed

Abandoned beach

Channel scarp (ticks indicate downslope side)

Bedrock outcrop (not Precambrian)

Crag and tail (head of symbol indicates stoss side)

Crevasse filling

Drumlin (outline to scale)

Glacial fluting

Karst area

Sink hole

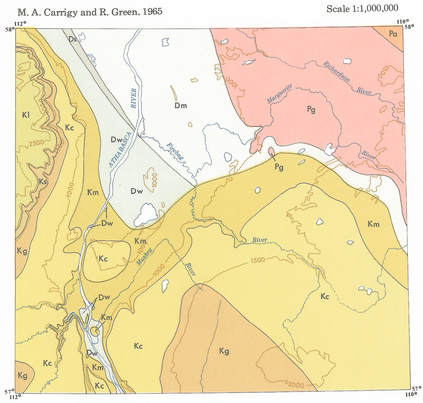
† Detailed Precambrian geology is presented in RCA Map "Geology of the Marguerite River District", by J. D. Godfrey, 1970.

Geology by L. A. Bayrock, 1969, 1970

BEDROCK GEOLOGY

M. A. Carrigy and R. Green. 1965

Scale 1:1,000,000



LEGEND

CRETACEOUS

Kl Labiche Formation: *dark grey shale and silty shale*

Ks Shaftesbury Formation: *dark grey shale, silty shale*

Kg Grand Rapids Formation: *fine-grained sandstone, siltstone and silty shale*

Kc Clearwater Formation: *dark grey silty shale, siltstone*

Km McMurray Formation: *quartzose sandstone, siltstone; oil impregnated*

DEVONIAN

Dw Waterways Formation: *argillaceous limestone and grey shale*

Ds Slave Point Formation: *grey and brown limestone, dolomitic limestone*

Dm Middle Devonian (undivided): *includes brown dolomite, gypsum, anhydrite*

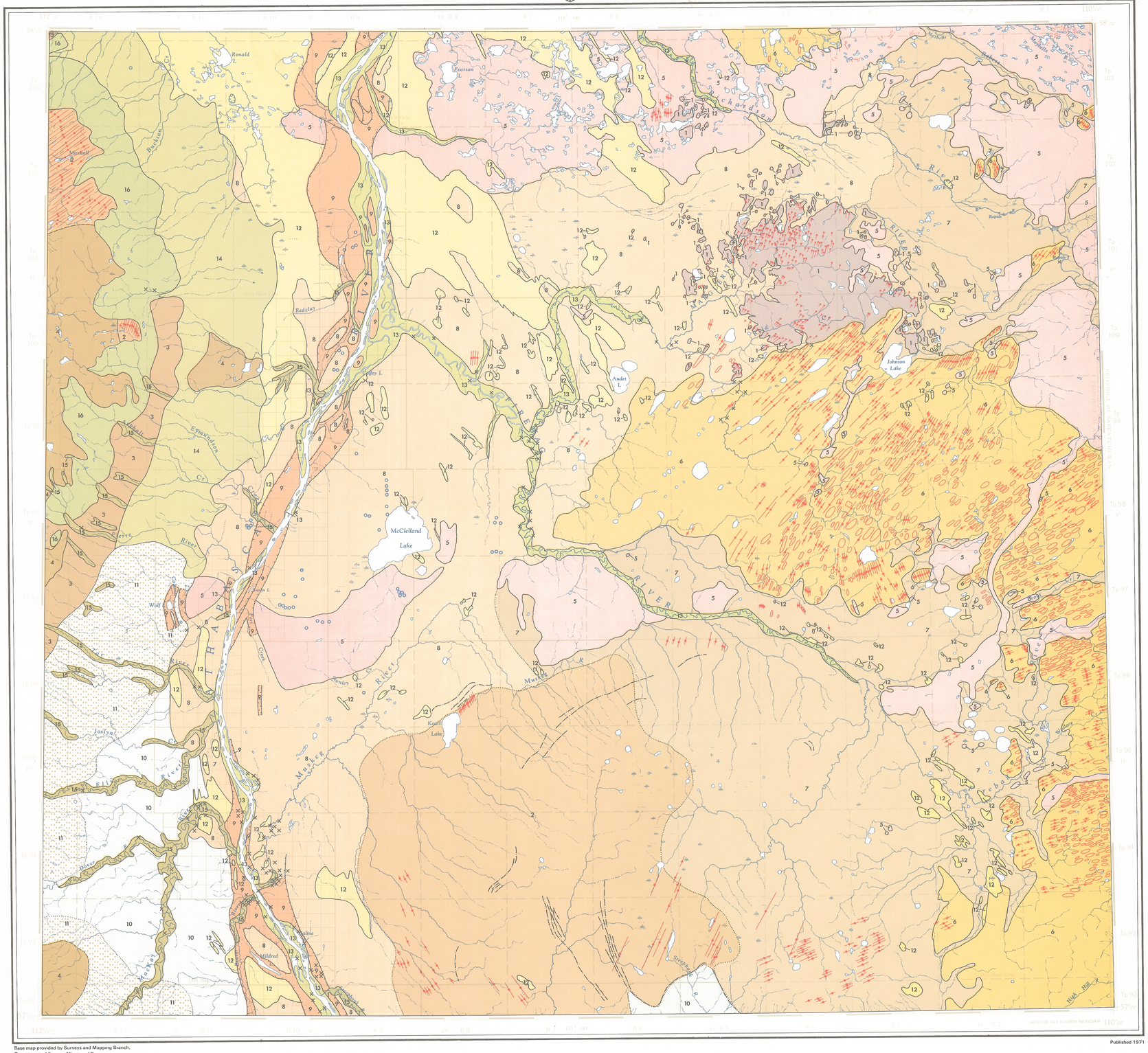
PRECAMBRIAN

Pa Athabasca Formation: *medium- to coarse- grained sandstone*

Pg Granitic plutonic rocks

Geological boundary

Surface contour (contour interval 500 feet)



Base map provided by Surveys and Mapping Branch, Department of Energy, Mines and Resources; modified by Surveys Branch, Alberta Department of Highways and Transport

Cartographic editing by J. D. Root

Drawn by F. L. Copeland

Published 1971

MAP 34

SURFICIAL GEOLOGY BITUMOUNT

NTS 74E

LEGEND

River or stream

Intermittent river or stream

Lake

Township boundary

SCALE 1:250,000

1 Inch to 4 Miles Approximately

Miles 5 0 5 10 15 20

Kilometres 5 0 5 10 15 20 25 30

DESCRIPTIVE NOTES

BEDROCK GEOLOGY

The northeast portion of the map area, approximately 800 square miles in extent, is underlain by Precambrian crystalline rocks of the Canadian Shield, which crop out extensively in the crag-and-tail terrain adjacent to the upper reaches of Marguerite River. The rocks are mainly gneissic granite and granodiorite and mylonitized derivatives, forming a series of knobs and hills (crags) separated by depressions filled with glacial sand and gravel. A few square miles in the northeast corner of the area are inferred to be underlain by quartzose sandstones of the Late Precambrian Athabasca Formation (this formation outcrops extensively to the northeast in Saskatchewan).

The Precambrian is overlain disconformably by carbonate and evaporite strata of Middle to Late Devonian ages, which are inferred to underly glacial deposits in the lowlands adjacent to the Athabasca River in the north-central part of the map area. The Middle Devonian succession is composed of dolomite, minor dolomitic limestone and shale, interbedded with gypsum and possibly anhydrite units of unknown thicknesses. The Upper Devonian Waterways Formation comprises a succession of interbedded limestone and argillaceous limestone, exposed mainly along the Athabasca, Muskeg, and MacKay River valleys in the southwest part of the map area.

Strata of Early Cretaceous age underly much of the gently rolling terrain adjacent to the Athabasca River in the southwest part of the map area, extending under the highlands to the northwest (Birch Mountains) and to the east (Muskeg Mountain). The Cretaceous succession consists of oil-impregnated quartzose sandstone and silty shale of the McMurray Formation, overlain by bentonic marine shales and feldspathic sandstones of the Clearwater and Grand Rapids Formations. The youngest bedrock strata are the dark marine shales of the Shaftesbury and Labiche Formations, which cap the upper slopes of the Birch Mountains in the northwest corner of the map area. None of the Cretaceous units is well exposed outside of the Athabasca River valley and the lower reaches of its tributary streams; thus, lack of outcrop and borehole data in the heavily drift-covered southeast part of the map area makes differentiation of major rock units highly speculative.

SURFICIAL DEPOSITS AND LANDFORMS

Glacial Deposits

Till, which is unsorted material deposited from a glacier, is subdivided on the basis of topography: *ground moraine* has local relief less than 15 feet, and *hummocky moraine* has local relief more than 15 feet. The western slopes of Muskeg Mountain are overlain by sandy till (ground moraine) which grades eastward into outwash sands and gravels, derived in large part from quartzose Athabasca Formation sandstones. The upper surface of the Birch Mountains, underlain by shaly Cretaceous strata, is covered by ground moraine grading into hummocky moraine composed of loam to clay-loam till low in carbonate content. The eastern slopes of the Birch Mountains are covered in part by clay-loam till with a noticeable carbonate content derived from Devonian strata to the northeast. The slopes of the Birch Mountains and, to a lesser extent, the slopes of Muskeg Mountain have been subject to colluvial action, the tills there containing lenses of sand and silt near the surface.

Glaciofluvial Deposits

Ice-contact deposits are widespread in the central and northern parts of the area, consisting of kames, eskers, moulin kames, and crevasse fillings (designated by a single symbol on the map). The deposits vary widely in texture: gravel predominates in the kame complexes in the northeast, and sand in the Fort Hills-McClelland Lake kame moraines to the southwest. Elsewhere, such as the esker in townships 97 and 98, ranges 1 and 2, the deposits contain both sand and gravel in significant amounts. The kame deposits, which are end moraines marking different terminal positions of glacier advances, exhibit high local relief, up to 700 feet in the northeast. If it is assumed that the bedrock surface underlying this kame complex is concordant with the lowlands to the south and east, then the thickness of these sand-gravel deposits is approximately equal to the local relief.

Outwash plains constitute the most widespread type of surficial deposit, covering much of the area east of the Athabasca River. They are of three main types; sand outwash plains, sand and gravel outwash plains, and glaciated outwash plains. The last-named type, prevalent towards the eastern margin of the area, consists of sand and gravel that has been overridden by a subsequent ice advance to form a fluted and drumlinized surface which indicates the direction of ice movement. Generally, the drumlins are covered by boulder pavement, and the inter-drumlin areas contain sand and gravel near the surface. These deposits probably range in thickness from 60 to 200 feet. To the south and west of the drumlinized terrane, outwash plain deposits, which show little local relief, cover the lowlands adjacent to the Athabasca, Firebag, and Marguerite Rivers. They range from 2 to 20 feet thick in the southwest (mainly sand) to more than 50 feet in the northeast, where individual plains are terraced in relation to successive positions of the retreating ice front.

Meltwater channel sediments are found along the Athabasca River valley and probably include early (postglacial) terraces of the river itself. They are uniform in thickness and composition: from 10 to 20 feet of sand overlying 2 to 10 feet of gravel with boulders in many places. Numerous small meltwater channels also are associated with the kame and outwash plain complexes but are not shown on the map.

Glaciolacustrine Deposits

Fine-grained sediments of lacustrine origin have been divided into two units: those composed of mainly silt and clay and those composed of bedded silt, sand, and clay with pebbles and lenses of till-like material. On Muskeg Mountain (township 92, ranges 1 and 2) the small area of lacustrine deposits is mainly silty clay 10 to 20 feet thick; in the lowlands adjacent to MacKay River silt predominates, the thickness being less than 10 feet and generally ranging from 3 to 5 feet. Away from the river valley, towards the slopes of the Birch Mountains, the lacustrine deposits become more heterogeneous and massive-appearing in places, containing lenses of partly bedded sand, silt, and till-like material with scattered pebbles derived from ice-rafting and mud flows.

Aeolian Deposits

Medium- to coarse-grained sand deposits of aeolian origin are scattered over various parts of the area, being especially widespread in the northwest, adjacent to the Athabasca River valley. They are found as sheet deposits and as dunes, and are derived from associated outwash sands and gravels. The dunes are stable at the present time, having been formed shortly after deglaciation when the prevailing winds were from the southeast (prevailing wind direction nowadays is from the northwest). Some dunes have migrated considerable distances, such as those in townships 102 and 103, ranges 6 and 7, which are now stabilized on hummocky kame moraine.

Alluvial Deposits

Stream alluvium consists of Recent river and stream sediments, such as those along the valley of the Athabasca River. It is composed mainly of sand, except along some of the smaller and more slowly flowing streams where silt and clay also are common.

Alluvial fan deposits are widespread along the lower slopes of the Birch Mountains from township 98 north. The material is composed of approximately equal amounts of bedded sand, silt, and clay, having been derived from the erosion of soft Cretaceous bedrock and overlying till on the steep upper slopes of the Birch Mountains.

Erosional Features

These features may be classified as *stream valleys* and *slumps*. Slumping is limited to the steep upper slopes of the Birch Mountains, many portions of which show landslide scars. Materials involved in slumping are mainly soft Cretaceous bedrock, although till and other surficial deposits also are involved in some places.

Organic Deposits

Postglacial accumulations of organic materials, commonly called muskeg, mantle most of the surficial deposits in the area. In general, these deposits are thin (less than 5 feet thick), although they may attain a thickness of over 20 feet in places. Very thick organic deposits are present near McClelland Lake, in the lowlands adjacent to the Athabasca River and on top of the Birch Mountains.