GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

PRELIMINARY SERIES

LEGEND

Note: Weighted legend blocks indicate map-units that appear on this map

CENOZOIC

QUATERNARY

Q — Glacial till, outwash, alluvium, etc.; mapped only where deposits are thick and continuous

Qm — Thick morainal deposits forming prominent topography (Amundsen and Great Bear lobe moraines)

TERTIARY and/or QUATERNARY

Tb — BEAUFORT FORMATION (?): unconsolidated gravel and sand; quartzite, dolomite and black chert pebbles; wood fragments

MESOZOIC

CRETACEOUS

UPPER CRETACEOUS

Kps — "Pale shale zone": pale grey shale and mudstone; grey brown ferruginous shale; minor ironstone concretionary beds

Kbt — "Bituminous zone": black bituminous shale; yellow jarosite; local earthy hematite; pale grey clay; local basal ironstone-pebble and shale-chip conglomerate

LOWER CRETACEOUS

Kb — "Bentonitic zone": black, soft, plastic shale; fossiliferous orange ironstone concretionary beds

Ks — "Silty zone": upper division – argillaceous siltstone and mudstone; lower division – light grey friable sandstone and coal

Ksh — Undifferentiated shales, equivalent to the "Silty", "Bentonitic", and "Bituminous" zones

Kss — Basal sandstone, white, very fine to coarse-grained, crossbedded, partly calcareous, commonly porous, locally oil-stained; equivalent to lower division of "Silty zone"

K — Cretaceous deposits (Undivided)

PALEOZOIC

DEVONIAN

UPPER DEVONIAN

Di2 — IMPERIAL FORMATION: shale, brown, greenish grey, generally fissile; subordinate sandstone, brown, impure, very fine grained; minor siltstone

Di1 — Basal unit; shale, brown, fissile, with siltstone laminae and clay ironstone concretions

Di — IMPERIAL FORMATION (Undivided)

Dc — CANOL FORMATION: shale, dark brown to black, mostly bituminous, partly fissile, partly siliceous and blocky

MIDDLE AND (?) UPPER DEVONIAN

Drk — RAMPARTS AND KEE SCARP FORMATIONS (Undivided); limestone, generally well bedded and partly argillaceous below, massive above; commonly fossiliferous

MIDDLE DEVONIAN

Dhi — HARE INDIAN FORMATION: shale, black and highly fissile at base, green above; beds of siltstone and fossiliferous limestone locally developed

Dh — HUME FORMATION: limestone, well bedded and rubbly, highly fossiliferous; shales in middle and lower parts

MIDDLE AND (?) LOWER DEVONIAN

Db — BEAR ROCK FORMATION: dolomite and limestone solution-breccia; bedded brown bituminous dolomite and dense limestone; gypsum

ORDOVICIAN AND SILURIAN

UPPER ORDOVICIAN AND LOWER SILURIAN

RONNING GROUP

OSk — MOUNT KINDLE FORMATION: dolomite, brownish grey to medium grey, fine crystalline; locally colour mottled; silicified fauna common

LOWER AND (?) MIDDLE ORDOVICIAN

RONNING GROUP

Or2b — Unit 2b: dolomite, pale yellow-brown to pale grey; mainly medium crystalline, abundant white and yellowish grey stromatolitic and locally oolitic chert, abundant drusy quartz

Or2a — Unit 2a: dolomite, pale brownish grey, fine to coarse crystalline; interbedded with dolomite, greyish orange, very fine crystalline, partly laminated

Or2 — Unit 2 (Undivided)

Or1 — Unit 1: dolomite and rare limestone; cyclic repetitions of dense, laminated beds, oolite beds, conglomerate beds, stromatolitic beds and thin dolomitic shale beds

OSr — MOUNT KINDLE FORMATION and Unit 2 (Undivided)

CAMBRIAN

Cs — SALINE RIVER FORMATION: red and green shales, gypsum, halite, siltstone; dense flaggy dolomite with salt-crystal casts

Ccp — MOUNT CAP FORMATION: green, grey, and minor red shales, glauconitic sandstone and siltstone; subordinate orange-weathering dolomite in some areas

Cck — MOUNT CLARK FORMATION: sandstone, white, grey, locally red, quartzose, fine to very coarse-grained and conglomeratic, crossbedded, partly friable

Rock outcrop
Rock outcrop visited by helicopter
Fossil locality (GSC catalogue number where collection taken) — C1769
Geological boundary (defined, approximate, assumed; includes contacts extended by air photo interpretation)
Geological marker
Limit of geological mapping
Bedding, tops known (horizontal, inclined, overturned)
Bedding estimated on photos or from aircraft (horizontal; dip 5°–15°: 15°–45°)
Fault, movement unknown (defined, inferred)
Fault (defined, inferred; solid circle on downthrown side)
Fault, thrust or reverse (defined, inferred; teeth extend down-dip)
Anticline (defined, approximate; arrow indicates plunge)
Syncline (defined, approximate; arrow indicates plunge)
Monocline (arrows on steepened limb)
Sinkhole
Area of sinkholes
Oil seep or showing
Stratigraphic section studied — MN-10

Stratigraphic Section References

W.S. MacKenzie MN-10
R.W. Macqueen MQ-10

Geology by J.D. Aitken, M.E. Ayling, D.G. Cook, W.S. MacKenzie, R.W. Macqueen, 1968

Compiled by J.D. Aitken and D.G. Cook 1969

Geological cartography by the Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada, 1969

Topographic base-map at the same scale published by the Army Survey Establishment R.C.E., 1961

Geographical names subject to revision

Magnetic declination 1969 varies from 38° 27' easterly at centre of west edge to 38° 52' easterly at centre of east edge. Mean annual change: −6.9'

Published, 1969
Copies of this map may be obtained from the Geological Survey of Canada, Ottawa

INDEX MAP

MAP 6-1969

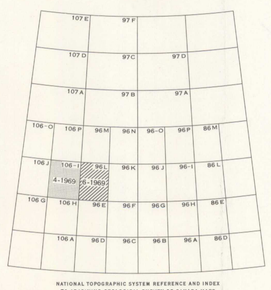
GEOLOGY

LAC BELOT

DISTRICT OF MACKENZIE

Scale 1:250,000

Miles 4 0 4 8 12 Miles
Kilometres 6 0 6 12 18 Kilometres



NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

National Topographical System designations indicate other quadrangles mapped geologically during Operation Norman

Printed by the Surveys and Mapping Branch

DESCRIPTIVE NOTES

Geological mapping was carried out in 1968, as part of Operation Norman of the Geological Survey of Canada.

Most of the map-area lies within the highest part of Anderson Plain (Bostock, 1964), which is a plateau cut by steep-walled stream valleys. On this plateau, only the resistant carbonate rocks and, to a lesser extent, the basal Cretaceous sandstone, outcrop away from the valley walls. Outcrops of Devonian shales are rare, even along the incised streams.

The northern end of the arcuate Jacques Range, the outermost element of the Franklin Mountains, crosses the south-central part of the map-area. This feature consists of uplifted carbonate rocks which are locally well exposed. Two less pronounced uplifts, Tunago Ridge and Belot Ridge, belong to the Colville Hills physiographic province (ibid.) and provide exposures little better than those of the plateau whose continuity they interrupt.

The thick sequence of marine strata, predominantly dolomites, lying between the Cambrian Saline River Formation (not exposed in the area) and the Devonian Bear Rock Formation, and including the Mount Kindle Formation, is assigned to the Ronning Group (Hume, 1954). The oldest rocks exposed are assigned to the basal unit (Or1) of the Ronning Group and probably do not exceed 200 feet in thickness. The unit consists of dolomite characterized by cyclic repetitions of dense, laminated beds, oolite beds, conglomerate beds, stromatolitic beds and thin beds and partings of green dolomitic shale; the unit is recessive and weathers yellow. The basal unit of the Ronning is part of an apparently conformable succession containing Cambrian fossils below (Mount Cap Formation) and Lower Ordovician fossils above (Unit Or2b of the Ronning Group). Its age, therefore, may be Cambrian or Ordovician.

Dolomite occurring between the basal unit of the Ronning Group and the Mount Kindle Formation are mapped as Or2. Along Hare Indian River in the eastern half of the map-area, and in map-areas to the east and northeast, this unit is divisible into an upper division(Or2b) of medium- and coarse-crystalline dolomite characterized by abundant bedded and stromatolitic chert and quartz-lined vugs, and a lower division (Or2a) consisting of fine- and medium-crystalline dolomite lacking chert and quartz-lined vugs. In the western part of the map-area, as in the Franklin Mountains, the stromatolitic chert-bearing division (Or2b) is not well developed and the rocks are assigned to Or2. The succession is at least 700 feet thick, and consists almost entirely of pale brownish or yellowish grey dolomite: thin-bedded and recessive below, and lighter-coloured, thick-bedded and more resistant above. Chert is not prominent; stromatolites in the upper part are of a type which are extensively silicified farther east.

The Mount Kindle Formation (OSk) of Williams (1922), lies disconformably on the older units of the Ronning Group and is bounded above by the sub-Devonian unconformity. It consists of brownish grey to medium grey, fine-crystalline, very thick-bedded, resistant dolomites characterized by horizons of abundant nodules of white chert and a silicified fauna of Late Ordovician and Early Silurian age. The thickness ranges from 128 feet at section MQ-11 on Hare Indian River to at least 425 feet at Good Hope Bay on Great Bear Lake. Locally, the contact between the Mount Kindle Formation and the underlying unit (Or2: Or2b) is difficult to recognize and to trace on air photographs. In such areas the Ronning Group has been left undivided and is shown as OSr.

Nomenclature applied to Devonian strata is that of Bassett (1961), except that the name Ramparts Formation is retained in its original sense, as suggested by Caldwell (1964).

The Bear Rock Formation (Dbr) lies unconformably on the Ronning Group, and consists of laminated to thick-bedded, pale brown, very fine crystalline dolomites; thin-bedded, pale grey weathering, pelletal limestones; and rarely exposed white gypsum. Thick units of dolomite and limestone solution-breccia occur throughout the map-area, and the bedded carbonates are commonly brecciated. Postglacial or postglacially rejuvenated sinkholes and subterranean drainage indicate that subsurface solution of gypsum is now in progress. Similar activity took place in Cretaceous time, as is indicated by sinkholes now filled with Cretaceous sandstone. The thickness of the Bear Rock Formation could not be determined in the map-area. An incomplete section at Sam McRae Lake, two miles south of the area, is about 800 feet thick, and evidence from wells drilled near Fort Good Hope and Rond Lake suggests that this figure may be an approximate maximum for the map-area. Fossils are rare, but include the giant ostracod Moelleritia canadensis which suggests an early Middle Devonian (Eifelian) age.

The Hume Formation (Dh) lies with apparent conformity on the Bear Rock Formation and consists of very fossiliferous, brown, dense, thin- and medium-bedded limestone that is characteristically rubbly in outcrop. Beds and partings of brown shale, known to occur in the middle and lower parts of the formation, are not exposed in the area. The formation outcrops as three or more persistent scarps which are excellent photogeological markers. The thickness is estimated to be between 350 and 450 feet. In wells drilled near Fort Good Hope, the Hume Formation is 340 feet thick. Abundant fossils indicate a Middle Devonian (early Givetian) age.

The recessive Hare Indian Formation (Dhi) lies conformably on the Hume Formation and outcrops rarely within the map-area. Lateral variations in thickness and lithology are pronounced. The persistent basal member consists of dark brown, fissile, bituminous shale characterized by abundant Tentaculites and thin beds of fibrous limestone. A bed of limestone with abundant brachiopods (Leiorhynchus castanea) is generally present near the base. Higher beds consist of greenish grey, grey, and pale brown shales, with minor thin beds of calcareous siltstone and, locally, beds of fossiliferous limestone. This interval weathers pale yellow and can be easily recognized from the air. West of Lac à Jacques, one or more thick beds of very fine-grained, calcareous, quartzose sandstone are present in the upper part of the Hare Indian Formation, and form a low but distinct scarp. It was not possible to obtain a precise thickness within the map-area, but the formation appears to be about 250 feet thick west of Lac à Jacques. This is unusually thin because the formation is about 700 feet thick in a well at the Ramparts on the Mackenzie River, 20 miles to the west. The fauna of the Hare Indian Formation indicates a Middle Devonian (Givetian) age.

Stratigraphic problems concerning the Kee Scarp and Ramparts Formations, which may or may not constitute a single lithogenetic unit, are not yet resolved. In my event, their separation in the course of reconnaissance mapping is not practical, and they have been mapped as an undivided unit (Drk). The lower, "Ramparts" part consists mainly of medium-bedded, brown, partly argillaceous limestones characterized by or largely formed of transported fragments of branching tabulate corals. This unit grades by facies change into the Hare Indian Formation along the Mackenzie River downstream from Fort Good Hope. The upper, "Kee Scarp" part is thick-bedded and massive, and consists of pale brown limestone, commonly with large globular stromatoporoids. The undivided Ramparts-Kee Scarp is a local development within the Devonian succession (Bassett, 1961), and is markedly lenticular. Its eastern limit in the map-area may approximate its original depositional limit. Its maximum thickness is estimated to be about 100 feet. The type Ramparts Formation is of Middle Devonian (Givetian) age. The age of the Kee Scarp Formation is in dispute and is either Middle or Late Devonian.

The Upper Devonian Canol and Imperial Formations have been removed from the map-area by pre-Cretaceous erosion.

Only one Cretaceous formation, the basal sandstone (Kss), outcrops in the map-area. This quartzose sandstone is white, except at the many localities where it is oil-stained. The vertical variation in grain size is extreme and abrupt even between adjacent laminae. Layers of quartz and chert pebbles occur locally. Calcite cement is widespread, and locally causes "lustre-mottling". Where not calcareous, the sandstone is friable and porous; many exposures consist of unconsolidated white sand. Crossbedding is ubiquitous. Within the map-area the basal sandstone lies with profound regional unconformity on all older formations down to the Bear Rock Formation; 25 miles to the east, it lies on the Ronning Group. This basal Cretaceous sandstone, whose thickness is not known to exceed 100 feet, was deposited on a topographic surface with at least 200 feet of relief. East of Lac à Jacques, a Cretaceous mesa supported by the resistant Ramparts-Kee Scarp strata, is partly buried by the sandstone. The unit is correlative and continuous with the lower sandstone and coal division of the "Silty zone" of the Anderson River region (Yorath et al., 1969). On this basis, its age is probably late Early Cretaceous.

All consolidated formations in the map-area, up to and including the basal Cretaceous sandstone, were deformed during the compressional movements that gave rise to the structures of the Franklin Mountains and Colville Hills. The Franklin Mountains display an unusual tectonic style in which ridges are asymmetrical anticlines, or homoclines fronted by high-angle faults. These folds are characterized by widely diverging trends and abrupt reversals of asymmetry.

In Jacques Range, as elsewhere in the Franklin Mountains, thrust or reverse faults are present. The study of thrust faults in Jacques Range led to the interpretation of thrust or reverse faults bounding homoclinal ridges elsewhere, where only the upthrown block is exposed. This interpretation is consistent with the common dying-out of homoclinal ridges into anticlines.

The Colville Hills may have had an origin similar to that of the Franklin Mountains because they exhibit a similar, though more subdued geometry, and are linked spatially by the merging of Tunago Ridge (Colville Hills) with Jacques Range (Franklin Mountains) just south of the map-area. Consequently, faults bounding Tunago Ridge and the southern part of Belot Ridge are also interpreted as reverse faults. The local occurrence of overturned beds in Tunago Ridge supports this conclusion. The northern two thirds of Belot Ridge is a steep-limbed anticline whose crest is characterized by chaotic structure and trench-like lineaments. These may be tectonic features or they may be due to joint enlargement and collapse attendant upon solution of underlying gypsum.

The entire area was covered by Laurentian ice during the last glaciation.

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MAP 6-1969
LAC BELOT
DISTRICT OF MACKENZIE