

Ottawa

Abstracted for
Geo-Science Data Index

Date _____

246-1-5-31

GREAT BEAR LAKE AREA

REPORT OF SUMMER 1970 GEOLOGICAL FIELD PARTY

ATLANTIC RICHFIELD CANADA LTD

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Enclosure

Great Bear Lake Area - Outcrop And Sample Locations, Scale: 1" = 64,000',
by K. S. Raskin, October, 1970.

Introduction

The portion of the Great Bear Basin described in this report lies within 64° to 67° latitude and 120° to 125° longitude in the District of Mackenzie. Great Bear Lake is in this report area.

Duration of the field party was from July 26th to August 14th, 1970. Personnel consisted of two geologists; Henri Raasveldt and Keith Raskin and pilots; Ron Austin, Mike Papirny and Don Holliers.

Logistics And Accessibility

Main settlements in the area are Fort Norman and Norman Wells on the Mackenzie River, Fort Franklin at the head of the Great Bear River, and Port Radium on McTavish Arm of Great Bear Lake. The fishing lodges at Great Bear Lake include Plumber's, Bronson's, Great Bear and Great Bear Trophy Lodges.

The Mackenzie River, Great Bear River and Great Bear Lake are accessible by boat. Barges operate on the Mackenzie River. Barges travel from the Mackenzie River up the Great Bear River to Bear Landing and Fort Franklin. A weekly barge also runs in the summer between Fort Franklin and Port Radium.

An airfield is at Norman Wells. Pacific Western Airlines has a scheduled service to this airfield. A small landing strip is present at the Great Bear Trophy Lodge on Ford Bay.

The field party used the Great Bear Trophy Lodge as a base camp. The geologists stayed in tents and the pilots stayed in the lodge. Meals for the field party were provided by the lodge.

The Atlantic Richfield's float-equipped Turbo Beaver, piloted by Ronald Austin, was used for transportation during the first week. A Peace Air Ltd.'s float equipped Cessna 185, piloted by Michael Papirny, was used for two days during the second week. Transportation for the duration of the field trip was provided by a Gateway Aviation's float equipped Beaver piloted by Donald Hollier. A gas cache was set up earlier in the year at the lodge by ARCO's pilot Ron Austin. Additional aviation fuel was obtained from Norman Wells.

Five days of field work were lost due to inclement weather.

Climate

The area is characterized in the summer by storms and northeast winds. In the vicinity of Great Bear Lake, fog and low lying clouds may persist for two or three days at a time. The average July temperature is about 55°F. Great Bear Lake freezes over in the period from late October to mid-November. Break-up normally occurs from the middle of June to mid-July, however break-up as late as July 26th has been reported.

Physiography

The Great Bear Basin lies in the interior plains physiographic division of the Northwest Territories. On the west it is bounded by the faulted and folded Devonian and Older Paleozoic Rocks of the Franklin Mountains. On the east it is bounded by cratonic Precambrian sediments and granites of the Canadian Shield.

Great Bear Lake occupies 12,000 square miles of this basin. The five arms of the lake are Smith, Dease, Keith, McTavish and McVicar. The lake is 512' above sea level. Average water depth is between 200 and 300 feet with depths as deep as 1400 feet in McTavish Arm. Shoals are present at the western end of Smith Arm. Great Bear Lake is drained primarily by the Great Bear River, which flows into the Mackenzie River. Most of the rivers flowing into Great Bear Lake are slow moving and carry little sediment. The area south of Smith Arm is characterized by abundant swamps, ponds and small lakes linked by sluggish streams.

The area has been subjected to multiple continental glaciation, and glacial deposits of varying thickness are wide spread. Scented Grass Hills and Grizzly Bear Mountain, are covered by Knob and Kettle moraine. Both areas have hills over 2000 feet above sea level.

Previous Geological Work

The first geological investigation of the Great Bear Lake region was made by Dr. John Richardson in the 1820's as part of the Second Franklin Expedition. Later investigation has been confined to a few brief geological visits.

Outcrops in the vicinity of Smith Arm and Scented Grass Hills were examined as part of Operation Norman by the G.S.C. in 1968. "The Colville Lake Map Area and Ermine Map Area, N.W.T. Report (1970)", presents the preliminary results of the Operation Norman reconnaissance mapping. This report has been referred in this field report as G.S.C. (1970).

Results of the G.S.C. mapping of the eastern part of this area are shown on G.S.C. Map 18 - 1960.

Stratigraphy

Precambrian, Siluro-Ordovician and Cretaceous strata are exposed on the periphery of Great Bear Lake. These strata are almost completely masked by extensive Quaternary deposits.

Cretaceous bedrock is believed to be widespread in the area west of McVicar Arm. The paucity of Cretaceous outcrop may be attributed not only to the widespread Quaternary cover but also to the recessive soft Cretaceous shales and unconsolidated sands.

In the field, five geological units were recognized. These are:

UNIT 5: Quaternary deposits.

UNIT 4: Cretaceous, shales, clays, sandstones, lignites.

UNIT 3: Siluro-Ordovician carbonates.

UNIT 2: Precambrian siliceous dolomite with stromatolite-like structures.

UNIT 1: Precambrian reddish-brown and yellow-brown sandstones and siltstones.

Unconformities are present (G.S.C. 1970) between the Precambrian and Cambrian, Ordovician-Silurian and Devonian. The Cretaceous oversteps older formations to the east, and overlies unconformably, Devonian, Ordovician, and Cambrian Strata.

On the accompanying map, sample locations are designated by number and outcrop areas by letters.

Precambrian (Units 1 and 2)

Precambrian rocks crop out on the eastern shore of Great Bear Lake. Outcrops of Precambrian age were examined at two localities "K" and "L". Precambrian outcrops were aerially observed one mile inland from the northwest shore of Dease Arm at the Bloody River and 20 miles northeast of Cape MacDonnel.

The Narakay Islands' outcrops "K" are red and yellow weathering, well indurated, laminated siltstones and very fine-grained quartz sandstones. Bedding is flaggy to blocky (Unit 1). Ripple marks are present. Quartz conglomerate lenses were observed. The quartz pebbles of the conglomerate average 1/4" in diameter. Lithologically this unit is similar to the G.S.C.'s lower unit of the Hornby Bay group. (G.S.C. Map 18-1960). On the island visited, a thickness of approximately 200 feet is exposed.

On an island eight miles to the southeast of Bloody River mouth, Dease Arm, outcrop "L", abundant stromatolitic rocks are exposed (Unit 2). These laminated rocks are composed of siliceous dolomite. Pink green and black chert laminae are present in some of the stromatolite structures. These stromatolites are characteristic of the G.S.C.'s Upper Hornby Bay group. (G.S.C. Map 18-1960).

Cambrian

Cambrian strata was not examined by the 1970 field party.

Siluro-Ordovician - (Unit 3)

The oldest Paleozoic rocks cropping out on the lake shore are of Siluro-Ordovician age. Upper Ordovician rocks cannot be differentiated from Silurian rocks. (G.S.C. 1970). Consequently, they are grouped together

as Siluro-Ordovician. Siluro-Ordovician rocks are exposed at Manitou Island in Keith Arm, the southern part of Grizzly Bear Mountain, and in outcrops A & B at the western end of Keith Arm. The G.S.C. has assigned the strata of these exposures to the Mount Kindle formation. The Mount Kindle is the youngest formation of the Ronning Group. (G.S.C. 1970).

At Grizzly Bear Mountain, immediately north of Jupiter Bay, outcrop "G" light-grey, sub-angular jointed beds believed to be Siluro-Ordovician were aerially observed. (Unit 3). At "G", when the lake is calm, these Siluro-Ordovician beds may be seen beneath the lake surface.

The upper and lower contact of the Siluro-Ordovician was not viewed.

Siluro-Ordovician beds, outcrop "A", were examined and sampled on the west limb of an anticlinal feature northeast of Ford Bay. The outcrop is grey, dense, fine-to-microcrystalline dolomite. An intraformational dolomite breccia was collected at sample location 27. Also in this area is a whitish-grey weathering, laminated dolomite.

On the southwest side of Good Hope Bay, outcrop "B" is another anticlinal feature. From aerial observation, the rocks of this structure appear to be the same lithology as "A".

Devonian

Devonian rocks were not exposed in the area examined by the field party.

Cretaceous - (Unit 4)

Cretaceous rocks are exposed at only a few localities but are thought to underlie a large portion of the surficial cover in this area. They overstep progressively older formations to the east.

Cretaceous outcrops were examined at Knife Point, "C", the northwest shore of Douglas Bay, "D" the southern and eastern shore of the Scented Grass Hills, "E" and "F", and outcrops "H", "I", "J" at Grizzly Bear Mountain.

Outcrops of possible Cretaceous age were aerially observed on the north shore of the lake but they were not examined due to lack of time.

Samples 1-6, and 38-42, were collected at Knife Point, "C". Sample 1 is a dark grey flaky shale. Samples 38-42 were taken from a sequence of alternating shales and carbonaceous sands.

Sample 5 consists mainly of unconsolidated white, fine-grained quartz sand. Sample 6 is composed of a reddish-brown friable, fine-grained quartz sandstone. The sand has a small percentage of coarse, well-rounded quartz grains. The sandstone is poorly cemented, iron stained, and has powdery calcareous cement.

A reddish-brown, friable, fine-grained sandstone crops out half a mile inland, on a ridge at sample location 3.

Sample 2 at the top of Knife Point Hills consists of shale chips and bentonitic clays.

A friable, platy dark grey shale containing chitinous fish scales, fish skeletal fragments, and selenite, samples 22 and 23, crops out at Grizzly Bear Mountain and Scented Grass Hills.

The fish scale shale was also observed on the Scented Grass Hills at outcrop "E" and sample location 37. The shales at sample location 34 contain concretions up to 2 feet in diameter.

At location 36, Scented Grass Hills, a 5 foot thick siltstone is interbedded with the shales. Under a small waterfall, sample locations 32-35, shales and a 2 foot fibrous calcite bed (sample 33) are exposed. On Grizzly Bear Mountain, at sample locations 15, 16 and 17 dark grey platy shales were collected. At 16 and 17 the shale had a bluish sheen which may be due to manganese.

Samples 8, 9, 10, 11 and 12 were collected from outcrops on the northwest shore of Douglas Bay. Wood fragments up to 6 inches can be found in the coaly shales (sample 11). The sand, 12a, is made up of fine to coarse grained moderately well-sorted, sub-angular quartz grains.

A coaly shale and interbedded sand was observed at location 18.

Quaternary (Unit 5)

The whole region is believed to have been subjected to extensive glaciation during the Pleistocene. Great Bear Lake is interpreted to have been part of an extensive glacial lake that extended to the south and included Great Slave Lake. Glacial deposits of varying thickness are present. Knob and Kettle moraine covers the tops of hills at Scented Grass Hills and Grizzly Bear Mountain.

In sheltered locations medium to coarse grained sand beaches occur. Beaches exposed to extensive wave action are composed of cobbles and boulders. In many localities, such as Ikanyo Island, Douglas Bay, large boulders fringe the shore line. Old strand lines are preserved on some of the islands, such as Ikanyo; and in the Cape MacDonnell area. We observed sand spits building out from the lake shore. At Ford Bay, the Great Bear Trophy Lodge is located on such a sand spit.

At other locations, such as the bay immediately east of the Katseydie River mouth located on the north shore of Smith Arm, Dunes have developed behind the beach. The dunes are partially stabilized by vegetation.

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APR 5 1971

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