CANADA

DEPARTMENT

OF

MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

PAPER 50-21

PRELIMINARY MAP

CHRISTIE BAY
NORTHWEST TERRITORIES

(MAP AND DESCRIPTIVE NOTES)

By

I. C. Brown

OTTAWA

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DESCRIPTIVE NOTES FOR CHRISTIE BAY MAP, NORTHWEST TERRITORIES

PHYSICAL FEATURES

The main body of Great Slave Lake crosses the boundary between the Canadian Shield and the bordering area of Palaeozoic rocks, and the east arm of the lake extends at right angles to the contact for 175 miles into Precambrian formations. The basin of the arm owes its existence to deep erosion of a belt of mixed hard and soft rocks that is bordered on three sides by uniformly more resistant formations, mainly granitic. Within the map-area, which covers the central part of the east arm, the general level of bordering lands and of numerous islands and peninsulas in the lake rises gradually from 450 feet above the lake in the southwest corner of the area to 800 feet in the northeast part, and reaches elevations of 900 to 1,000 feet a few miles inland from the north shore of the lake. The granitic uplands bordering the lake basin present a monotonous succession of low rocky hills and ridges, with local relief rarely exceeding 150 feet. The upland south of the basin rises abruptly along a fault escarpment 700 to 800 feet above the lake, whereas north of the lake rocky slopes rise gradually to plateau level at 1 mile to 4 miles inland. Rivers entering the lake basin follow either poorly defined valleys or deep gorges, and are unnavigable for 2 to 12 miles inland. The monotonous aspect of the bordering uplands contrasts sharply with the rugged and picturesque topography within the lake basin, where high cliffs of conglomerate and diabase rise nearly vertically from the water's edge and steep slopes of shale are protected by cappings of harder formations. Structure of the underlying rocks is especially well reflected in the form of large peninsulas in the north part of the lake, where gentle south slopes follow the dip of formations and steep north slopes form a series of cuestas on the outcropping edges of alternating layers of hard and soft strata.

Glacial boulders are widely scattered over much of the map-area, but thick morainal deposits are rarely seen except in the northwest corner where the bedrock is thickly drift covered. Bouldery hills, 50 to 100 feet high and composed of unsorted, angular, granitic boulders and coarse gravel, occupy much of the country to the north and west of McKinlay Lake: they range from irregular ridges and knobs to elongated drumlins whose long axes trend southwest, parallel with the direction of glaciation. Eskers composed of sand and coarse gravel form ridges up to 40 feet high that can be traced for miles.

The country around the east arm of Great Slave Lake is generally thinly timbered with spruce, birch, pine, tamarack, and poplar. Spruce trees are the most abundant and are up to 18 inches in diameter, although most of them are much smaller. The best stands of timber are found on south-facing slopes along the lake shore. On the bordering upland areas a few miles back from the lake trees seldom exceed 6 inches in diameter.

GENERAL GEOLOGY

Two major unconformities are easily recognized within the succession of Precambrian rocks in the map-area, and these divide the formations naturally into three main groups. Surficial rocks of each group were invaded by igneous intrusions, and those of the older two groups were steeply folded, were probably mountain built, and were deeply eroded to a nearly level plain before formations of the youngest group were deposited.

YELLOWKNIFE GROUP

The Yellowknife group (1,2) of sedimentary and volcanic rocks is the oldest recognized. These rocks were originally named the Point Lake-Wilson Island group by Stockwell (Maps 377A, 378A) and were divided on the basis of a marked difference in lithological character into the Point Lake phase, largely sedimentary gneiss and schist, and basic volcanic

rocks, conglomerate, arkose, iron formation, and dolomite. On later maps the Archaean volcanic and sedimentary rocks, corresponding to the Point Lake phase, have been called the Yellowknife group, and this terminology is used on the accompanying map. The rocks included in the Wilson Island phase are not in contact with the typical Yellowknife group rocks, from which they differ markedly in lithological character and degree of metamorphism, but they are older than the surrounding Proterozoic rocks and, therefore, are referred to in this report as the Wilson Island group.

The intermediate to basic volcanic rocks of the Yellowknife group(1) are dark to light green, fine-grained andesites, dacites, and basalts that have been recrystallized and are now composed of fresh, green hornblende, plagioclase feldspar, and quartz. Pillows and ropy flow structures are well preserved, and some of the flows contain amygdules.

The Yellowknife sedimentary rocks are divisible into knotted quartz-biotite schist and hornfels(2a) and feldspathic paragneiss(2b). This division is based on degree of metamorphism, and contacts between the two types are drawn arbitrarily, as every gradation exists between them. Bedding planes strike northerly and dip steeply, but not enough reliable top determinations could be made to indicate the nature of the folds.

Within the map-area, the Wilson Island group(A) occurs only around Basile Bay and Basile Lake. It consists of a great thickness of northeasterly trending strata of phyllite, schist, and crossbedded quartzite, with interbeds of dolomite and iron formation. These rocks are correlated with the Tazin group as developed in several areas between Great Slave Lake and Lake Athabasca.

GRANITIC ROCKS

Granitic rocks(3) are widespread on uplands bordering Great Slave Lake, but underlie only a few small areas within the basin itself,

where they are exposed at the centres of anticlines and near faults. The granitic intrusions include a wide variety of rocks. They are light grey to pink, of medium to coarse grain, and are composed of quartz, plagioclase feldspar, microcline, and biotite, muscovite, or hornblende. Biotite granite and granodiorite(3) and muscovite granite(3a) are the most common types. So far as known, all the granite throughout the area intrudes the rocks of the Yellowknife group, but granite of more than one age may be present.

In places, particularly near the contacts with sedimentary schist and gneiss, the granitic rocks(3b) contain inclusions of partly assimilated sedimentary material. The inclusions are elongated lenses and bands of quartz-biotite schist or paragneiss injected by stringers of granitic material, and have the same attitude as beds of nearby areas of sedimentary gneiss and schist.

GREAT SLAVE GROUP

The Great Slave group of sedimentary and volcanic rocks (4-9) was deposited on an old erosion surface developed on granitic intrusions and the upturned edges of Yellowknife sedimentary and volcanic rocks. For the most part it forms an easterly trending, asymmetrical synclinorium 150 miles long, most of the east half of which lies within the present map-area and occupies almost the whole of the lake basin. The beds on the north limb commonly dip from 5 to 10 degrees south, whereas the strata on the south limb are generally folded into a series of anticlines and synclines with limbs commonly dipping from 30 to 70 degrees. The group is divided into a lower and an upper part.

The lower part of the Great Slave group comprises three formations, named, in ascending order, the Sosan, Kahochella, and Pethei. These are best seen on the north limb of the synclinorium where the structure is simple. There the Sosan formation(4) is perhaps 3,000 feet thick, and consists of beds of sandstone and quartzite with partings of shale and with from 1 foot to 10 feet of arkose and conglomerate at the base. Where

observed the basal members rest on granite and are composed largely of detrital material derived from the granite. The Kahochella formation(5) consists of about 1,000 feet of shaly sediments, with some laminated, argillaceous limestone, jasper, and oolitic iron formation. The iron formation is well exposed 10 miles south of Taltheilei Narrows, where it is associated with lava flows, tuff, volcanic breccia, and agglomerate. The Pethei formation(6) comprises about 1,500 feet of limestone and dolomite characterized by algal structures in some beds. On the south limb of the synclinorium, the Pethei formation is generally missing, and the rocks of the upper part of the Great Slave group apparently rest on the Kahochella formation, suggesting that the two parts may be separated by an erosional unconformity.

The upper part of the Great Slave group occupies the central part of the synclinorium. In ascending order are: the Stark formation(7) consisting of possibly 1,000 feet of interbedded, varicoloured dolomite, red shale, and limestone, including some layers that are much brecciated; the Tochatwi formation(8) comprising a thick assemblage of shaly sediments and sandstone; and the Pearson formation(9) of columnar-jointed lava flows, with interbeds of argillite.

Most of the clastic strata of the Great Slave group are red or brown, and many beds show ripple-marks, crossbedding, and mud-cracks. Concretions occur locally in shale and argillite. The Great Slave group resembles the limestones and associated strata on the Belcher Islands in Hudson Bay, and may be of about the same age as the Animikie rocks of the Lake Superior region.

The Union Island group(B) is of unknown age relative to the Great Slave group, but like it was deposited in the time interval that followed the erosion of the granite and preceded the deposition of the Et-Then group. The Union Island consists of dolomite stratigraphically overlain by interbedded, varicoloured dolomites, red argillite, and black slate.

DIORITIC INTRUSIONS

All members of the Great Slave group as well as the granite and older surficial formations are cut by dykes, sills, and stocks of dioritic and syenitic rocks(10). These intrusions outcrop here and there along the more steeply folded south limb of the synclinorium. The dolomite in a bay 3 miles west of the southwest end of McDonald Lake is cut by white microcline-albite-muscovite granite(10a).

ET-THEN GROUP

The Et-then group of coarse, clastic, sedimentary strata was deposited on an erosion surface developed on the dioritic and older rocks. The Murky formation(11) of conglomerate forms the base of the group and carries closely packed, round boulders of a great variety of rocks representing almost every member of the older groups. The conglomerate varies greatly in thickness up to, probably, several thousand feet, and is locally missing. The sandstone and quartzite of the succeeding Preble formation(12) are coarse, feldspathic rocks, exhibiting excellent crossbedding and ripple-marks. The Et-then may be correlated with the Athabaska series of the Lake Athabasca region and may be of Keweenawan age. The conglomerate and sandstone are nearly flat lying except in the vicinity of faults, where dips are up to 70 degrees. These faults are of great magnitude, commonly strike northeasterly, and are confined to the southern, more complexly folded part of the area. They have displaced the Et-then and all older rocks.

DIABASE

Diabase dykes and sills(13) cut the Et-then group as well as all older rocks and the large faults. The sills are as much as 500 feet or more thick and 95 miles long, and occur in the gently dipping rocks of the north part of the map-area. In the more complexly folded rocks of the southern part of the area, the diabase characteristically takes the form of moderately dipping dykes of irregular trend. Other dykes dip

vertically, strike slightly west of north, and cut both gently dipping and complexly folded strata and diabase sills as well as bordering granitic rocks. All structural types show excellent columnar jointing. The sills and moderately dipping dykes form prominent topographic features.

ECONOMIC GEOLOGY

The volcanic and sedimentary rocks of the Yellowknife group are similar to those of the neighbouring Beaulieu River and MacKay Lake areas where many gold deposits and several base-metal deposits have been found. Quartz veins are abundant in both volcanic and sedimentary rocks on the north shore of McLeod Bay and around Basile Bay. A little gold and silver has been reported from one vein near Basile Bay, and lead and zinc minerals occur in knotted schist 6 miles northwest of Thompson Landing, just north of the map-area. Quartz-calcite veins carrying disseminated chalcopyrite are found in Yellowknife sedimentary rocks and in muscovite granite west of the mouth of Burpee River, near Thompson Landing, and near the mouth of Barnston River. The same type of quartz-calcite vein with chalcopyrite occurs in granitic rocks at many points north of McLeod Bay. Uranium has been found in paragneiss and pegmatite near Barnston River. Nickel occurs in volcanic rocks 5 miles northwest of Sachowia Point.

Veins of quartz occur in the Great Slave group, the dioritic intrusion, and the Et-then group. They are not known to contain gold or more than a trace of silver, but many of them carry calcite, barite, and chalcopyrite. Copper minerals are found in brecciated sandstone and in fractures in diabase near Taltheilei Narrows and on islands 6 miles northeast of the narrows, on the south side of Tochatwi Bay and at the east end of Portage Inlet, on the north shore of Stark Lake, on Murky Channel, near Pekanatui Point, and in carbonate veins cutting syenite at the southwest end of Et-then Island. Cobalt bloom was observed to the west of Taltheilei Narrows. Oolitic hematite beds as much as 30 feet

thick are exposed 5 miles north of Utsingi Point; similar deposits, up to 20 feet thick, occur at several other localities on the lake, but all are low grade. A large, low-grade sedimentary deposit of thorium and uranium occurs in ferruginous dolomite at McLean Bay.