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CANADA  
DEPARTMENT  
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MINES AND TECHNICAL SURVEYS

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GEOLOGICAL SURVEY OF CANADA

PAPER 50-15

PRELIMINARY MAP  
**RELIANCE**  
**NORTHWEST TERRITORIES**  
(MAP AND DESCRIPTIVE NOTES)

By  
I. C. Brown



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OTTAWA

1950

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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 the 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 eastern end of the east arm, the general level of bordering lands and of peninsulas in the lake is 800 to 1,000 feet above the lake. The granitic uplands bordering the lake basin present a monotonous succession of low rocky hills and ridges, with local relief rarely exceeding 250 feet. The upland south of the lake rises abruptly along an escarpment 700 to 800 feet above the lake, whereas north of the lake rocky slopes rise gradually to plateau level at 1 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 picturesque and rugged topography within the lake basin, where high cliffs of diabase and limestone 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 lake basin, where gentle south slopes follow the dip of formations and steep north slopes form a series of cuestas on the outcropping edges of alternate layers of hard and soft strata. To the south, Nonacho Lake also owes its existence to erosion of a belt of soft rocks bordered by more resistant formations.

Glacial boulders are widely scattered over much of the map-area, but thick morainal deposits are rarely seen except in the eastern third of the map-area where the bedrock is thickly drift covered. Bouldery hills, 50 to 100 feet high and composed of unsorted, angular, granitic and gneissic

boulders and coarse gravel, occupy much of the country to the south of Artillery Lake; they range from irregular ridges and knobs to elongated drumlins whose long axes trend slightly south of west, parallel with the direction of glaciation. Eskers composed of coarse sand and coarse gravel form ridges up to 40 feet high that can be traced for miles. Along Lockhart and Snowdrift Rivers there are almost continuous sand plains averaging 1 mile to 2 miles in width.

The country from Artillery Lake south to Snowdrift River is barren of trees except for a few, small, widely scattered stands of scrub trees from 1 foot to 6 feet high. Elsewhere the country is thinly timbered with spruce, birch, pine, and tamarack. Within the basins of the larger lakes and on south facing slopes trees are up to 18 inches in diameter, whereas on the more exposed upland areas they seldom exceed 6 inches.

The lakes and streams abound in fish. Northern pike, suckers, and, in the larger lakes, trout and whitefish, are the most common varieties. The fur-bearing animals of the district include the otter, beaver, lynx, wolverine, mink, fox, and martin. Black bears and wolves are plentiful. With the exception of moose, game is scarce in the summer. Great numbers of caribou from the barren lands to the north and east spend the winter within the area.

#### 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, namely, those of the Yellowknife, Great Slave, and Et Then groups. In addition to these, and separated from them by granitic intrusions, is the Nonacho group of sedimentary rocks. Surface rocks of each group are 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

Yellowknife group(1,2) of sedimentary and volcanic rocks is the oldest recognized. Rocks similar to these were originally named the Point Lake-Wilson Island group by Stockwell<sup>1</sup> and were divided on the basis of a marked

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<sup>1</sup>  
Stockwell, C.H.: Geol. Surv., Canada; Map 377A, Eastern Portion of Great Slave Lake (west half) and Map 378A, Eastern Portion of Great Slave Lake (east half), 1936.

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difference in lithological character into the Point Lake phase, largely sedimentary gneiss and schist, and basic volcanic rocks, and the Wilson Island phase, consisting mainly of quartzite and schist, acidic 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 designated Yellowknife group, and this terminology is used on the present map. The rocks included in the Wilson Island phase are not exposed within the Reliance map-area. The intermediate to basic volcanic rocks of the Yellowknife group(1) are green to pale pink, fine-grained dacites and quartz basalts that have been recrystallized and are now composed of plagioclase feldspar, fresh green hornblende, biotite, and quartz. Volcanic structures are poorly preserved, but distorted pillows and amygdules are recognizable. The sedimentary rocks(2) consist of well-banded, feldspathic paragneiss, garnetiferous quartzite, and some knotted quartz-biotite schist and hornfels. Bedding planes strike northeasterly and dip steeply, but reliable top determinations could not be obtained to indicate the nature of the folds.

### 'Older' Granitic Intrusions

Granitic rocks(3) are widespread on uplands bordering Great Slave Lake and Nonacho Lake. Within the basin of Great Slave Lake they underlie only a few small areas, where they have been exposed along the axes 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, chlorite, or hornblende. Granodiorite, granite, and quartz monzonite are the most



common types. So far as known, all the granitic rocks of the map-area are younger than the Yellowknife group, but may be of more than one age.

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

Small bodies of muscovite granite and pegmatite(4) cut the 'older' granitic intrusions throughout the map-area, but only one of these, in the northwest corner, is large enough to map.

Swarms of meta-gabbro and meta-diorite dykes, not shown on the map, but similar to those at Yellowknife and Gordon Lake, cut the granitic intrusions and paragneiss north of the McDonald fault, between Daisy and Acres Lakes and for 8 miles south of the south end of Artillery Lake.

#### Great Slave Group

The Great Slave group of sedimentary and volcanic rocks was deposited on an old erosion surface developed on granitic intrusions. For the most part it forms an easterly trending asymmetrical synclinalorium 150 miles long, the eastern end 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 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, and these are best seen on the north limb of the synclinalorium 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 laminated,

argillaceous limestone, jasper, and oolitic iron formation, and minor 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 is generally missing, and 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(10), consisting of possibly 1,000 feet of chiefly interbedded, varicoloured dolomite, red shale, and limestone, including some layers that are much brecciated, and the Tochatwi formation(11) comprising a thick assemblage of shaly sediments and sandstone. A third member, the Pearson formation, is not exposed in the map-area, but occurs a few miles to the west.

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 limestone and associated strata on Belcher Islands in Hudson Bay, and may be of about the same age as the Animikie rocks of the Lake Superior region.

#### Nonacho Group

The Nonacho group of sedimentary rocks was deposited unconformably on the older group of granitic intrusions. It is composed of conglomerate, slate, arkose, quartzite, and greywacke; one type grades into another, and beds and lenses of conglomerate and slate occur interbedded with arkose and quartzite. In general, the conglomerate(7) is several hundred feet thick and in places has a thickness of at least 2,000 feet. It is composed almost entirely of pebbles of granite and allied rocks; and near the base consists of closely packed, angular, granite fragments from 1 foot to 2 feet in diameter in an arkosic matrix composed largely of small granite fragments.

The slates and greywackes(8) are fine- to medium-grained, dark grey to black weathering rocks. The arkoses and quartzites(9) are buff, yellow, and light grey weathering rocks of fine to medium grain. Crossbedding, grain gradation, ripple-marks, and mud-cracks are common.

The conglomerates, arkoses, and quartzites of the Nonacho group lie in a series of open, gently plunging folds except locally where folding may be closer, and beds in places overturned. The dip of the beds on the limbs of the folds varies mainly from 45 to 60 degrees, but dips up to 80 degrees are not uncommon. Folds within the slates and greywackes, in contrast with the open folds within the arkoses and quartzites, are closely compressed.

The Nonacho sedimentary group may be correlative with the lower part of the Great Slave group of Great Slave Lake. Lithologically it resembles the Sosan formation of the Great Slave group.

#### 'Younger' Intrusions

All members of the Great Slave group are cut by dykes, sills, and stocks of dioritic and syenitic rocks(12), which outcrop here and there along the more steeply folded south limb of the synclinorium. Granitic intrusions(12a) cut the Nonacho sedimentary rocks to the east of Nonacho Lake, and near the contact have altered the arkose and quartzite to a pink, glassy, quartzose rock, and the slates and greywackes to phyllites and micaceous schist. The 'younger' granite is so similar lithologically to the 'older', Archaean granite that the two cannot be separated except where they are in actual contact with Proterozoic formations. For this reason some areas of Proterozoic granite probably have been mapped as Archaean.

#### Et-then Group

The Et-then group of coarse, clastic sedimentary strata was deposited on an old erosion surface developed on Proterozoic intrusions and older rocks. The Murky formation(13) 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 overlying Preble formation does not occur in this map-area, but is exposed in the adjoining Christie Bay map-area<sup>1</sup> to the

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<sup>1</sup>

Brown, I.C.: Geol. Surv., Canada, Paper 50-21, 1950.

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west. The Et-then group may be correlated with the Athabaska series of the Lake Athabasca region, and is probably of Keweenawan age. The conglomerate is 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 mostly confined to the southern, more complexly folded part of the basin of Great Slave Lake. One of these, the McDonald fault, crosses Reliance map-area and the adjoining Christie Bay map-area. The faults have displaced the Et-then group and all older rocks.

#### Diabase

Diabase dykes and sills(14) 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 basin of Great Slave Lake. In the more complexly folded rocks of the southern part of the basin, the diabase characteristically takes the form of moderately dipping dykes of irregular trend. Within the basin 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. In the upland areas, diabase dykes, commonly 150 to 200 feet wide, maintain constant widths and strikes for long distances. Most of them trend north-westerly, but a few strike northeasterly, and all dip steeply to vertically. Both dykes and sills show excellent columnar jointing, and the sills and moderately dipping dykes form prominent topographic features.

## ECONOMIC GEOLOGY

Quartz veins are abundant in the sedimentary rocks of the Yellowknife group on the north shore of McLeod Bay. Chalcopyrite-calcite lenses have been prospected near Bigstone Point, and claims have been staked on Fairchild and Maufelly Points, where there are numerous, small, chalcopyrite-carbonate stringers.

Rocks of the Great Slave group are cut by many, large, hematite-rich carbonate veins, and there are large areas of rusty gossan. Similar gossan zones were noted in the paragneiss near Daisy Lake, and a large, yellowish gossan, high in graphite, occupies most of the long peninsula in this lake,

Quartz veins are numerous in the sedimentary rocks near Nonacho Lake, particularly around the 'younger' granite body east of the lake. Few of them contain sulphides, but those that do generally occur near contacts with this granite. The most common sulphides in the veins are pyrite, chalcopyrite, and galena.

Hydro-electric power could be developed in large quantities at Lockhart River.

