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GEOLOGICAL SURVEY

PRELIMINARY REPORT

CREE LAKE AREA, SASKATCHEWAN

BY

J. C. Sproule

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By J.C. Sproule

INTRODUCTION

Location and Access

Cree Lake area is in northwestern Saskatchewan on the crest and on the north slope of the Mackenzie River-Hudson Bay watershed. The area is bounded by longitudes 106°00' and 108°00' and by latitudes 57°00' and 58°00'.

Two main water routes lead into the area. One is from McMurray, Alberta, via Clearwater and Virgin Rivers, into the western part of the area. The other route leaves the railhead at either Big River or Meadow Lake and follows down Beaver River to Ile-a-la-Crosse Lake and Churchill River, up Mudjatik and Gwillim Rivers, into the Cree Lake area.

When time is an important factor the most practical method of entering the area is by plane from McMurray, Alberta, or from Prince Albert or Big River, Saskatchewan. Numerous and well-distributed bodies of water upon which planes may land serve this mode of travel within Cree Lake area.

Travel Routes Within the Area

Route to Lake Athabaska. The historic route from Churchill River to Lake Athabaska, indicated by Sir John Franklin on his map of 1819-20, is the best known in the area. In connection with Mudjatik River, Franklin's map bears the notation "Said to afford a passage to the Athabasca Lake by crossing a height at its source". The passage referred to is provided by Mudjatik and Gwillim Rivers, the portage route over the height of land, Cree Lake and River, and Stone River to the east end of Lake Athabaska.

The part of the route that is within Mudjatik area is described in Preliminary Report, Mudjatik Area, Saskatchewan, Geological Survey, Canada, paper 38-8.

The upper Gwillim River is common to both Mudjatik and Cree Lake areas. Along Gwillim River between the south border of the Cree Lake sheet and Solitude Lake there is only one series of rapids with a portage on the west side, 300 yards long.

Gwillim River splits before it enters Solitude Lake from the north. The west branch is an artificial cut-off made through sand by Chipewyan Indians. This branch now carries all the water. North of Solitude Lake the stream is swift, shallow, and very crooked. Sharp roots and branches of trees embedded at all angles in the sand and mud, detected with difficulty because of the brown colour of the water, are some of the hazards of canoe travel. The distance from Solitude Lake to the height of land portages is only $3\frac{3}{4}$ miles, whereas by water it is estimated to be 20 miles. Last summer (1937) the Cree River Trading post built an automobile road from Solitude Lake to the waterways north of the height of land, and transported their winter's supplies by truck.

The regular height of land portage route between Gwillim River and the second lake above Brustad River loads through three small lakes. The total length of this part of the route is $2\frac{1}{2}$ miles. Between the portages and Cree Lake there are no impediments to travel. It is 46 miles from the mouth of Brustad River to the outlet of Cree Lake into Cree River. Such a large body of water would be exceedingly dangerous for canoe travel were it not for the irregular shore lines and abundance of islands.

There are about 8 miles of rapids and ill-defined portages between Cree Lake and the north boundary of the map-area. Cree River over this interval is shallow, swift, and dangerous.

An alternative route loads from Cree Lake through Weitzel Lake and Pipestone Lake and River north to the lower part of Cree River.

Virgin River. Virgin River is navigable by canoe from Virgin Lake to where it passes out of the map-area to join the Clearwater River route to McMurray. In the upper 10 or 12 miles the river is particularly swift and shallow and the bed is bouldery; there are many places where an 18-foot canoe must be dragged. The lower part of the stream, however, and the elongate lake expansions in its course, generally have sufficient water to float an 18-foot canoe. An overland route, a portion of which is indicated on the accompanying map, loads from Virgin Lake over the height of land to McFarlane Lake.

McFarlane River. Except for its smaller size McFarlane River, between McFarlane Lake and the north border of the map-area, appears to be the same sort of a stream as Cree River, swift, shallow, and full of angular fragments and slabs of sandstone. It is for this reason a poor canoe route. Several portages are necessary in the upper part of the stream, but lower down it is more practical simply to wade with the canoes.

From a point $5\frac{1}{4}$ miles below McFarlane Lake, an overland and water route leads southwest from McFarlane River to Clearwater River.

It is possible to travel by canoe up Norseman River to Norseman Lake, but the stream is a poor canoe route. There are six portages and numerous rapids on Norseman River.

Engemann Lake-Cree River Route. One of the routes followed by the author's party in 1937 included Engemann Lake and the lower part of a stream emptying into it at the south end. All rapids encountered were waded. From this stream the route led east up the second tributary and thence to Pipestone Lake through a series of lakes, separated in most cases by moraine hills varying in height from 75 to 175 feet. Pipestone River was followed downstream for a short distance whence the route led east by way of another lake to strike Timson River at a narrow, lake-like expansion.

One party traversed downstream from this point to an irregular lake one mile north of the Cree Lake sheet, from which a portage was made overland to Cree River. A second party traversed south up Timson River and by land and water through a series of lakes to a small but easily navigable brook that empties into Cree River 8 miles north of Cree Lake.

Timson River is small and has many bouldery rapids in it suitable only for travel downstream with light canoes, except in periods of high water. Portage routes to Cree River are not cut, but the high areas are open and sandy and can be crossed anywhere.

Brustad River and the Route to Black Birch Lake. Below the first rapids and portage, Brustad River is sluggish and winding. Above the first rapid the current is stronger and there are an increasing number of shallow, bouldery rapids until Ubiquity Lake is reached. The stream between Ubiquity Lake and Brustad Lake is reported to be navigable by canoe, but with difficulty. It was observed by the writer's party only from occasional traverse lines, at which points it appeared to be navigable.

A lake and portage route passes southwestward from Ubiquity Lake to Black Birch Lake in Mudjatik area. The route is a good one as the lakes are not broad and portages are short and well defined.

From the above route to Black Birch Lake one may reach Virgin River by way of a small stream that drains one of the lakes at latitude $57^{\circ}06'$. It runs from the lake outlet north and west to Nyberg (Twin) Lakes, thence downstream to Virgin River. This stream is fairly good for about 3 miles below the outlet. The next 4 miles were not traversed by the writer's party, but from the air several rapids and portages were seen. The succeeding 3 miles to Nyberg (Twin) Lakes is broken by several small rapids and two chutes, both with short

portages on the south side of the stream. The river is relatively good from Nyberg (Twin) Lakes to Virgin River; there are only two or three small rapids and one fall with a 12-yard portage on the north side of the stream.

An alternative to the previously described route to Black Birch Lake lies parallel to it on the east side. This one leads through Esker Lake and the string of lakes and creeks to the southwest. The portages are not all out, but as a rule cross open, sandy parkland between the lakes.

Karras River. On Karras River between Cree Lake and Karras Lake there are nine rapids and falls and two portages, one of which is 260 yards and the other 660 yards in length.

From Karras Lake a canoe route leads southwest through a series of lakes, then over two open portages, 660 yards and 1,500 yards in length, to Brustad Lake.

Mudjatic River. The upper part of Mudjatic River between the south boundary of the Cree Lake map-area and Mudjatic Lake is small and runs in a roundabout fashion through a number of irregular lakes. The most convenient canoe passage along this part of the route takes advantage of short cuts by going overland between lakes.

A trapper's canoe route from the vicinity of Mudjatic Lake to Cree Lake is said to exist, but its exact location is not known to the writer.

Other Canoe Routes. Besides those described there are numerous small streams in Cree Lake area that are navigable for short distances.

The American River route from Tommy Davis Bay to American Lake includes several lakes. The stream between the lakes is small and broken by many rapids, but the portage trails around them are good.

Another route from Cree Lake passes through MacIntyre (Bear) Lake and up a river full of shallow rapids, or over $1\frac{1}{2}$ miles of portage to the next lake south. The stream from there to Holgar (Little Bear) Lake is readily navigable by canoe.

Previous Work

In 1892, J.B. Tyrrell¹ travelled through the area on his way to Lake Athabaska by way of the previously described route through Cree Lake. Tyrrell recorded observations on the character of the water courses and the adjacent territory and on the rock outcrops encountered.

1

J.B. Tyrrell: Athabaska Lake and Churchill River; Geol. Surv., Canada, Ann. Ropt., 1895.

GENERAL CHARACTER OF THE AREA

Physical Features

The northern portion of the area, underlain by flat-lying Athabaska sandstone, is characterized by its low relief and the gently undulating character of the surface. Glacial sands, derived from the underlying sandstone, cover a large part of the surface. In well-drained areas the sandy soils support open stands of jack pine. Depressions are, as elsewhere, occupied by lakes and muskegs.

There are, however, several morainal areas on the sandstone that do not conform to the above description. Near Pipestone Lake, Norsoman Lake, and Virgin Lake, for example, numerous and closely crowded morainal ridges, mostly in the form of drumlins, trend at about 30 degrees west of south and range in height from 50 to 225 feet.

The flat-lying Athabaska sandstone has little effect on the drainage in this area. On the other hand, it is obvious from the general northeast-southwest disposition of the lakes and streams, parallel to the morainal ridges that lie between them and to the glacial striae, that glaciation has been the controlling factor.

South of the Athabaska sandstone area the topography is rugged. The hills have been slightly truncated by glaciers and the depressions partly filled by glacial debris, but not sufficiently

to have materially affected the relief. Differences in elevation are not great. Maximum relief for the Cree Lake area is about 350 feet.

Timber

In the Cree Lake area black spruce appears to be dominant on the granite and gneiss ridges and in the low muskog and swamp areas. Deciduous trees such as poplar and birch grow best on schists, gneisses, basic intrusives, and greenstones. Sandy soils, on well-drained surfaces, are covered with Banksian pine. About 62 per cent of the map-area is underlain by Athabaska sandstone and over all of this as well as over the drift-covered areas to the south the soils are of sand reworked by glaciation. For this reason much of it is open parkland covered with Banksian pine, with spruce being more or less confined to low areas and to areas of rock outcrop in the southern part of the region. Tamarack is widespread in swampy areas, but it is nowhere common.

There are no timber stands suitable for lumbering purposes within the area. Spruce or pine with a butt diameter of over 12 inches are rare.

Population and Industries

The fur industry is the only one within the area that has so far proved remunerative. Indians trap the area for $8\frac{1}{2}$ months, but for the remainder of the year they live in the vicinity of the Hudson's Bay posts at Ile-a-la-Cross, Patuanak, Beauval, and Elbow Lake. A few white men are permanent residents. Most of the fur-bearing animals come down from the barren lands with the cariboo in the winter and return north early in the spring.

Distance from markets is the only factor that prevents fishing from being a thriving industry. Trout, whitefish, pike, and pickerel abound in Cree Lake and numerous other lakes in the area.

There are few plots of ground suitable for the growth of garden produce. The soil is, as a rule, either sandy and barren of nutritious elements, or rich in organic matter, but soured by muskeg acids. Attempts have recently been made to grow vegetables at Stony Narrows of Cree Lake and at the outlet into Cree River, but

little success has been attained as yet.

GEOLOGY

General Statement

The oldest rocks exposed in Cree Lake area are biotite and garnet schists and gneisses, and quartzites, all presumably of sedimentary origin. Volcanic rocks partly altered to hornblende schists overlies and are to some extent interbedded with the sediments. Granites and related acid intrusives, as well as in one locality a gabbro body, intrude the sediments and volcanics. Flat-lying Athabaska sandstone covers the older rocks over much of the area. The sandstones are cut by diabase dykes in several localities.

Table of Formations

Athabaska sandstone; massive, crossbedded, and thinly banded quartz sandstone.

Granite, granite-gneiss, pegmatite, and related intrusives.

Acid to basic volcanic rocks partly altered to hornblende schists; many small sills and dykes of acid and basic intrusive rocks are included.

Sediments altered to biotite and garnet schists and gneisses; quartzites.

Sedimentary Rocks

The older Precambrian sediments in Cree Lake area (as differentiated from the Athabaska sandstone) are represented by biotite and garnet schists and gneisses, and by quartzites. They occupy only one small area, however, so that little evidence of their relationships to other Precambrian rocks of the area is available. They resemble sediments in Mudjatik area, which have¹ been compared by Alcock to those of the Wekusko series in Manitoba¹

¹

F.J. Alcock: Mudjatik-Haultain Area, Saskatchewan; Geol. Surv., Canada, Mem. 180 (1935).

The only area of older sediments on the Cree Lake sheet mapped as such is the continuation of a body that underlies the west lobe of Black Birch Lake in Mudjatik map-area. Here, as on Black Birch Lake, the biotite and garnet schists and quartzites occur interbanded with gneiss, and intercalated pegmatite dykes are characteristic. An occurrence of gabbro altered to amphibolite, about 200 yards long and 50 yards wide, was observed within the sedimentary area, but not in visible contact with the sediments.

Small areas of sediments occur in the Virgin River region, on either side of an elongate greenstone belt, but they are so altered and broken by granitic and dioritic intrusives that they are included with other types under the heading of mixed rocks.

Volcanic Rocks

A narrow, elongate area of volcanics 2 miles to over 3 miles in width extends from the southwest corner of the Cree Lake sheet north along Virgin River, to pass beneath the flat-lying Athabaska sandstone about 4 miles east of Virgin Lake.

The principal rock type observed is altered andesitic lava in which pillow, amygdular, and vesicular structures are present. One locality showed rhyolite porphyry and trachyte. The whole mass is considerably metamorphosed to hornblende, chlorite, and other schists, and intruded throughout the length of the area indicated by dykes and sills of granite, pegmatite, diorite, and basic intrusives. The relations between diorite and granite are not known, but granite intrudes gabbro 6 miles southeast of Virgin Lake. Intrusives comprise possibly 30 per cent of the total area.

The diorites and more basic volcanics are sparsely mineralized at numerous points by pyrite, chalcopyrite, pyrrhotite, and arsenopyrite.

The boundaries of the volcanic belt shown on the map are purely arbitrary. In the southern part of the area the transition eastward into gneisses is sharp, but along the whole of the west border the change from volcanic rocks to the mixed rocks appears to be gradational.

The rocks strike in the direction of elongation of the greenstone body. The prevailing dip is vertical to west.

Granite, Granito Gneiss, Pegmatite

A considerable part of the region south of the Athabaska sandstone area is underlain by a complex of granite and gneissic granite, diorite, and pegmatite. Nearly all the granite has some gneissic texture. The colours are pink to grey and the textures coarse and fine. Gradations exist from quartz-rich to quartz-poor and syenitic types, and to diorites. All transitions also exist between massive granite, granite gneiss, and intruded rock. In mapping, divisions between intrusives and country rock were made on a percentage basis.

The principal rock type is biotite granite, although hornblende granite is not uncommon. Orthoclase, microcline and albite are the main feldspars and biotite, hornblende, apatite, and magnetite the main accessories.

Pegmatites as dykes and small partings are common differentiates of the granite, particularly along contact zones. Molybdenite, found in one locality mentioned elsewhere in this report, is the only pegmatitic mineral of probable economic importance observed.

Mixed Rocks

The bodies of mixed rocks here described include an assemblage of rock types that were not mapped separately. In general granite comprises less than 25 per cent. The remaining rocks are, in order of abundance, gneisses derived from sedimentary and volcanic rocks, hybrid rocks, partly altered sediments and greenstones, pegmatites, basic intrusives.

Such areas are apparently remnant roof pendants in synclinal and faulted basins, highly injected and broken by intrusives. Lit-par-lit injections, as well as large dykes of pegmatite, are characteristic.

The hybrid rocks under consideration are sedimentary, volcanic, and basic intrusive rocks imperfectly assimilated by granite intrusives in such a manner as to be indefinable as either the invaded or the invading rock.

Two areas of mixed rock types occur in the southwest quarter of the map-area on either flank of the Virgin River greenstone band.

East of the greenstone the principal rock types are pink and gray, massive and gneissic granites, biotite and garnet gneiss, biotite and garnetiferous biotite schist, hornblende schist, pegmatite. In one locality massive granite was observed cutting biotite gneiss. The schists occur in elongate areas up to 200 yards or more in width and also intimately interleaved with gneiss and pegmatite. Pegmatites are the last formed of these rocks.

West of the greenstone the principal rock types are hornblende and biotite gneiss, granite, granodiorite, diorite, pegmatite, gabbro, pyroxenite, partly altered volcanics, and sediments. An area composed of interbanded granodiorite gneiss and pegmatite containing considerable amounts of glassy blue quartz, extends southward from about half a mile south of Virgin Lake. The rock strike here is variable, although 20 degrees east of north appears to be predominant. In places it is 40 degrees west of north. There is a certain amount of shearing in the direction 20 degrees east of north. Both pegmatites and gneisses are fractured, and magnetite, pyrite, and hematite have been deposited in the fractures. These metallic minerals are more concentrated along the sides of small fault valleys traversing the region in the direction of dominant shear (20 degrees east of north).

There is a small area of gneissic diorite, granodiorite, and granite, with small shreds of biotite and hornblende schist, and dykes of pegmatite, in the Esker Lake-Brustad River area. It is apparently the extension of the sedimentary area to the southwest, described previously.

The three narrow bands of mixed types in the southeast quarter of the map-area are extensions of similar rocks from Mudjatik area. They are composed of hornblende, biotite, and garnetiferous biotite schists, irregularly distributed through gneisses and granites.

Athabaska Sandstone

The Athabaska series was described by R.G. McConnell¹ in 1881 from outcrops along the south side of Lake Athabaska in

¹ McConnell, R.G.: Report on an Exploration in the Yukon and Mackenzie Basins, N.W.T.; Geol. Surv., Canada, Ann. Rept. 1888-1889.

Alberta and Saskatchewan. McConnell's type section is on the northern side of a large, semicircular body of rock that extends from near the west end of Lake Athabaska, east almost to Wollaston Lake. The convex margin of the area, directed toward the south, passes across the Cree Lake sheet from latitude $57^{\circ}33'$ on the west boundary, to latitude $57^{\circ}11'$ on the east.

Except for local inliers of the underlying crystalline rocks along the south boundary, all of the Cree Lake area north of this line, comprising 62 per cent of the map-area, is underlain by Athabaska sandstone.

The Athabaska series in Cree Lake area is not nearly so varied as it is farther north in the vicinity of Lake Athabaska. In Cree Lake area it is composed almost entirely of a white or buff-coloured sandstone (96 per cent quartz), massive to thin bedded or crossbedded. Many of the massive, as well as the crossbedded, strata contain numerous, irregular-shaped, light-coloured lime pellets up to an inch in diameter. No conglomerates were observed in place, although large, angular conglomerate boulders in the drift testify to the presence of parent rocks in the area. It is probable that conglomerates exist locally above the unconformable contact between the flat-lying Athabaska sandstone and the older Precambrian rocks. The exact contact was not anywhere observed, but all along the boundary zone the crystalline rocks exposed are rotted and disintegrated by long weathering, in sharp contrast to the same rocks freshly truncated and polished by glaciation.

Structure

Athabaska sandstones in Cree Lake area are flat-lying and undisturbed except for the occasional dykes of diabase that cut them. They overlie with marked unconformity all the older Precambrian rocks. The manner in which the surface of these older rocks passes insensibly beneath the flat-lying Athabaska sandstones without any appreciable change, bears witness to the great amount of erosion that must have taken place prior to the deposition of the sandstone. By comparison, practically none has taken place since that time.

The older Precambrian rocks exposed over the southern portion of the area are highly metamorphosed and the bedded members stand at high angles of dip. The structure is such as would be expected at the roots of ancient mountain ranges. The general trend of the mountain ranges is reflected in the direction of gneissosity and in the direction of elongation of the shreds and narrow bands of country rock left in the granite. Almost all the erosion took place before the Athabaska sandstone was deposited. The dominant strike is 20 degrees east of north and the prevailing dips vertical to east in the eastern, and west in the western, part of the area. The greenstone belt in the Virgin River area appears to represent the remnant east flank of a synclinal basin.

A zone of shearing and disturbance striking 37 degrees west of north crosses the southwest corner of the Cree Lake sheet. It passes through the Virgin River greenstone belt about 9 miles south of Virgin Lake, at which point there are numerous dykes of granite striking across the greenstone area at about 35 degrees west of north. Some fault valleys observed from the air about 6 miles southeast of where the disturbed zone crosses the greenstone area mark its position there. The disturbed belt passes southeast off the Cree Lake sheet in the vicinity of Maurice Lake and has been traced across the Mudjatik sheet to near the mouth of Norbert River. There is much shearing and jointing along this line, and it is apparent from the drag of the schistose and other linear bodies of rock adjacent to the line of disturbance that the movement on the east side has been northwest with respect to the west side.

In the south-central part of the Cree Lake map-area there is an area in which the structure does not conform to the general northeast-southwest trend. The gneissic and schistose rocks here trace gently curving and sinuous patterns, as in the Mudjatik-Haultain area to the south.¹

¹ Alcock, F.J.: Mudjatik-Haultain Area, Saskatchewan; Geol. Surv., Canada, Mem. 180 (1935).

ECONOMIC GEOLOGY

No economic mineral deposits have so far been proved to occur in Cree Lake area.

A large part of the area is covered by Athabaska sandstone and much of the remainder is deeply eroded, leaving only granites and gneisses, so that the area of favourable prospecting ground is relatively small.

Elsewhere on the Canadian Shield greenstone areas contain mineral deposits of economic importance. For this reason the Virgin River greenstone belt may be regarded as prospecting ground. Although no segregations of metallic minerals were found there by the writer's party, slightly mineralized fragments of dacitic volcanic from a ridge 3 miles southwest of Nyberg (Twin) Lakes were assayed and yielded traces in gold.

Low assays in gold have been reported by prospector trappers from rocks in the vicinity of American Lake and from near Brustad River 7 miles west of Stony Narrows, Cree Lake. A small amount of sulphides in schists was found in both these localities and samples were assayed, but with negative results.

A small, non-economic deposit of molybdenite was found 7 miles south of the southern extremity of Holgar (Little Bear) Lake. The molybdenite occurs as irregular grains in narrow quartz feldspar stringers cutting a band of hornblende schist.

Irregular deposits of peat occur in a bog area on the northeast side of Engemann Lake. Recent draining of the bogs has caused them to sink and to cave at their margins, exposing peat cliffs 10 feet high. The surface upon which the peat rests was not observed.

Tyrrell reported low peat cliffs along Cree River below the mouth of Rapid River.¹

¹ J.B. Tyrrell: Churchill and Nelson Rivers; Geol. Surv., Canada, Ann. Rept., 1895.
