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DEPARTMENT OF MINES AND NATURAL RESOURCES

MINES BRANCH

PRELIMINARY REPORT 47-3

on the

GEOLOGY OF THE

HUGHES LAKE AREA

GRANVILLE LAKE DIVISION
Manitoba

by

J. D. ALLAN

(Preliminary Map 47-3 in pocket)

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HUGHES LAKE AREA

INTRODUCTION

GENERAL STATEMENT

The Hughes Lake Area comprises approximately 165 square miles in the Granville Lake mining division of northern Manitoba. It lies between longitudes 100° 30' and 100° 45' west, and latitudes 56° 45' and 57° 00' north, within the region commonly referred to as the Lynn Lake district.

Many mineral claims were staked in the Hughes Lake Area during the fall of 1946 and the winter of 1947, and considerable surface exploration was done on many of these claims during the summer of 1947. Geophysical surveys were made on several properties, and diamond-drilling was done by Sherritt Gordon Mines Limited on the L.M. group on Hughes Lake, and by The International Nickel Co. of Canada, Ltd. on the M.W. group around Tulune Lake.

PREVIOUS WORK

The Hughes Lake Area is part of the east half of the Granville Lake Sheet. The geological reconnaissance of the Granville Lake district was done by J. F. Henderson in 1932 and G. W. H. Norman in 1933, and the results were published in Geological Survey of Canada, Summary Report 1933, Part C. The results of the work are also contained in Map 344A--the east half of the Granville Lake Sheet--issued by the Department of Mines, Ottawa, in 1936 on a scale of 1 inch to 4 miles.

PRESENT WORK

The present work was done during the period June 7th, 1947 to September 25th, 1947. The geology was mapped on a scale of 1 inch to 1/2 mile using the Mineral Claims maps NE 15 and SE 15, 64-C of the Manitoba Mines Branch. Corrections in the map have been made where errors were apparent and also in a few places where surveyed plans of claim groups were available. Traverses were made at intervals of 1,500 feet except where topography made traverses impractical.

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GENERAL CHARACTER OF THE AREA

The physical features of the area are similar to those of a large part of the Canadian Shield of which it forms a part; rounded rock ridges alternate with small lakes and muskeg-filled, low areas. The local relief in most places is less than 100 feet, but hills rise fairly abruptly from the low areas. Steep-sided ridges in some places probably represent fault scarps. One such feature extends three miles south from the south end of Muskeg Lake.

Rock outcrops are relatively few and are of little extent. Most of the outcrops are found on lake shores, on the edges and tops of hills, under uprooted trees, and on slopes where a thin covering of moss can be pulled off the rock.

Glacial deposits of sand and gravel are numerous and cover a considerable part of the area. Many of the glacial hills and ridges are found to be surrounding or tailing south from rock masses, so that small outcrops are frequently found on the tops or north ends of ridges which appear to be nothing more than large glacial deposits.

As in other parts of this general region spruce, jackpine, birch and tamarac are the common trees with alder and willow forming the underbrush. In general, jackpine covers the sandy ridges; spruce covers the rocky and wetter localities. Birch is found in small clumps in the drier parts of the area, whereas tamarac is confined to the wet swamps.

Fires have burned large sections of the area at different times. Depending upon the time since the fire, travel through these parts at present is either easier or more difficult than through unburned timber. West and south of Hughes Lake and along part of the Hughes River above Muskeg Lake, fires of about four years ago cleared out all the underbrush and left most of the burned timber standing. In places, notably along both sides of the southwest bay of Hughes Lake, where growth was scant, broad, clear ridges make traversing easy. In the southeast corner of the area, more time has elapsed since the fire that destroyed the timber, and the dead trees have fallen forming a thick tangle of deadfall through which it is very difficult to travel. In the northwest corner of the area, still more time has elapsed, and although much of the deadfall has decayed, a very thick growth of young jackpine makes traversing difficult and limits visibility to a few feet. Much of the area around Eagle Lake and south along the Eagle River has had no fires for many years, but stands of useful timber are few.

The Hughes River extends across the area from northwest to southeast. Throughout most of its extent it is a continuous series of rapids with short, quiet stretches between. Many of the rapids are navigable by canoe when going downstream, whereas considerable wading or portaging is necessary when travelling upstream. The portage route from Cartwright Lake to Hughes Lake is difficult as much of the trail was obliterated by fire and much of it lies in low, wet ground.

In 1947, "breakup" occurred on June 6th and "freezeup" on November 10th. Both of these dates are two weeks to a month later than the dates considered to be normal for the area.

GENERAL GEOLOGY

The rocks in the Hughes Lake Area are Precambrian in age and consist of various formations of volcanic and sedimentary origin intruded by igneous rocks ranging in composition from gabbro to granite. Most are highly folded and metamorphosed. Henderson, Norman, and Downie distinguished from the Granville Lake Area an older series of volcanic and pyroclastic rocks which they designated "pre-Sickle" rocks, unconformably overlain by conglomerate and a series of quartzose sediments which they termed the "Sickle Series". Both series are cut by igneous rocks. Bateman[1] found in the McVeigh Lake Area that the pre-Sickle group consisted of interbedded volcanic and sedimentary rocks, and he proposed the name "Wasekwan Series". Both series are found in the Hughes Lake Area. The Wasekwan series is assumed to be of Archean (Early Precambrian) age. As noted by Norman, the lithology and the relationships of the Wasekwan and the Sickle series resemble those of the Wekuskoan and Missi series described by Wright[2] in the area south of Flin Flon. An exact correlation is not necessarily implied, but the similarities suggest that the two groups are of the same general age. The general geology may be summarized in the following table.

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1 Bateman, J. D.; McVeigh Lake Area, Manitoba; Geological Survey, Canada, paper 45-14, 1945.

2 Wright, J. F.; Geology and Mineral Deposits of a Part of Northwest Manitoba; Geological Survey, Canada, Summary Report, 1930, Part C.

TABLE OF FORMATIONS

Precambrian	Intrusives	Quartz-feldspar porphyry and felsite; granite, diorite, quartz diorite; gneissic and sheared equivalents.
		Diorite, quartz diorite, granodiorite; gabbro, amphibolite.
		Sheared granite gneiss.
	Sickle Series	Arkose, greywacke, quartzite, conglomerate; derived schists.
	Unconformity	
	Wasekwan Series	Basic to acid volcanics; breccia, tuff, sediments, iron formation; hornblende schist and gneiss derived from the volcanics.

WASEKWAN SERIES

On the present map the Wasekwan series is subdivided into three main groups:

Division	Rock Types
3	Chiefly basic volcanics: hornblende schists and gneisses; 3a, porphyritic lavas; 3b, volcanic breccia; 3c, interbedded tuffs; 3d, quartzitic sediments; 3e, coarse-grained volcanics, possibly including associated intrusives.
2	Chiefly acid to basic volcanics; some sediments and iron formation; 2a, acid volcanics; 2b, basic volcanics; 2c, porphyritic andesite; 2d, amygdaloidal lavas; 2e, pillow lavas; 2f, volcanic breccia; 2g, tuff; 2h, sediments; 2i, coarse-grained volcanics possibly including associated intrusives.
1	1a, Chiefly tuffs and sediments with interbedded volcanics. 1b, tuff and acid volcanics. 1c, chiefly basic volcanics. iron formation.

The above subdivision of the Wasekwan series is applied only to the Hughes Lake Area and was made to give an indication of the structure. Until this complex series has been studied in more detail over more of its extent, an accurate subdivision cannot be made. Although divisions 1 and 2 are shown both in the south and the north part of the area, no definite marker horizons were found to indicate that these are the same divisions. If divisions 1 and 2 are repeated in the two parts of the area as indicated on the map, two fold axes trending east-west must lie in the central part of the area; if the divisions 1 and 2 in the north do not correspond to 1 and 2 in the south, no fold axes are necessary, and the structure may be monoclinal with a spreading apart of the series on the west side of the area owing to granitic intrusions. The latter interpretation seems to be indicated from information obtained in the adjacent areas.

The predominant rock type of the Wasekwan series is the common "greenstone"--hornblende schist or gneiss. The usual type is a dark grey to green, fine-grained volcanic rock, probably an andesite originally. On the fresh surface tiny hornblende crystals are numerous. In many places the rock is porphyritic, and the feldspar phenocrysts weather white, frequently in relief, producing a spotted surface. Thin sections show that the original rock has been recrystallized. The groundmass consists of well-aligned hornblende needles, grains of feldspar and some quartz. Some sections contain small flakes of biotite, and some have felted masses of hornblende needles. The feldspar phenocrysts now consist of one or more crystals of secondary plagioclase. In many places alteration has replaced the feldspar by a mass of epidote and chlorite. Pyrite has been introduced along fractures, usually accompanied by quartz.

In many outcrops the volcanics show a parallel banding representing individual flows, but the bands are not continuous for more than a few feet. Porphyritic and non-porphyritic bands may alternate several times in one outcrop. In an outcrop three-quarters of a mile north of Muskeg Lake, several highly porphyritic flows averaging three feet wide, apparently show an increase in grain size and development of phenocrysts gradationally away from the north edge of the flow. The fine-grained border on the south edge of the flow is limited to an inch or less. The interpretation from this outcrop is that the tops of the flows are to the north.

Pillow and amygdaloidal lavas occur in several places; frequently the two structures appear in the same flow. Most of the pillows are a foot and a half in width and two to three feet in length; some measure five feet in length. Many are stretched and contorted so that the original shape cannot be seen. Some outcrops show a banding which possibly represents extremely stretched pillows. Most of the amygdules are one-half inch or less in length, and are filled with quartz or calcite.

The best developed pillow structures were seen in outcrops north of Cartwright Lake, east of Cartwright Lake, along the upper Hughes River, and at the north end of Muskeg Lake. In all places where determinations were possible, tops of flows were indicated facing north. Less well developed pillows were seen west of Auni Lake and south of Key Lake. In the latter location, tops of flows appeared to be to the south, but this determination is doubtful. Determination of tops of flows by concentration of amygdules was not found possible.

Vesicular flows were seen in several places, and one small outcrop east of Cartwright Lake showed a highly twisted, ropey lava.

Volcanic breccia occurs in many places throughout the area. In most outcrops the matrix of the breccia is dark green, fine-grained and hornblendic--very similar to the basic flows. In places it is porphyritic with feldspar phenocrysts. Most of the fragments are ellipsoidal, measure about one inch by two inches, and are finer-grained and weather to a lighter greenish-grey than the groundmass. Most have a common orientation. In the porphyritic phases of the rock, feldspar phenocrysts may appear in both groundmass and fragments. It is believed that most of these volcanic breccias are flow breccias; that is, they were formed at the time the lava flow was cooling by the crust breaking up and being incorporated into the still molten part of the flow. In many outcrops flow lines are seen curving around the fragments. South of Key Lake one horizon carries rounded fragments or bombs some of which measure 18 inches across. Most of these are fine-grained, but some are coarser than the groundmass. This rock may have formed by "bombs" dropping into a molten flow. Breccia occurs along the east side of Hughes Lake. Most of this is volcanic in origin but two outcrops were seen in which the fragments are nearly round and seemed to be of several rock types. These outcrops may belong to the Sickle conglomerate which was deposited on an erosion surface of the Wasekwan volcanics.

In some outcrops the rock is more coarsely crystalline, approaching a diorite in appearance. These outcrops may represent the interior of massive flows, or may be intrusive material.

Metamorphism has altered the appearance of many flows; feldspar and hornblende crystals have increased in size, lineation and breccia fragments have become indistinct. In places, usually close to intrusive bodies, the volcanic rock has become a coarse plagioclase amphibolite.

Acid volcanic flows are represented by light green and grey, fine-grained or porphyritic rocks. They are not as widely distributed as the basic flows. South and east of Cartwright Lake the acid rocks are more extensive and are associated mainly with tuffs. Northeast of Pole Lake a zone of light green quartz-feldspar porphyry, feldspar porphyry, and felsite is believed to represent rhyolite and trachyte. This zone extends northeast to the granite contact and may be related to the acid flow and quartz-feldspar porphyry on the east side of Herman Lake. South of the acid flows between Pole and Ron Lakes is a band of dark grey to green rock which contains small phenocrysts of quartz and feldspar. This rock is probably a dacite. Outcrops in other parts of the area of fine-grained, grey rocks containing small hornblende crystals oriented at random are believed to be of trachyte flows.

Tuffs occur interbedded with the flow rocks, but in some outcrops they are the predominant rock-type. The tuffs are thinly laminated, grey to green in color, and in places weather to a very light shade. In thin section they are seen to consist of well-aligned hornblende in a groundmass of feldspar, quartz, biotite, epidote, and clinozoisite.

The sediments of the Wasekwan series in the Hughes Lake area are thinly-bedded, grey to brown, impure quartzites. They are associated in most outcrops with banded tuffs.

The iron formation is a fine-grained banded, white, green and black rock. Most of the bands are less than an inch thick, but the green bands may be several feet. The lighter bands are chert and the darker bands mainly magnetite. Dark green bands represent basic flows. Iron formation occurs at more than one horizon in the Wasekwan series.

Intrusive rocks of all types from gabbro to felsite cut the Wasekwan series.

SICKLE SERIES

Norman in his report on the Granville Lake District, (Geological Survey of Canada, Summary Report 1933, Part C), states: "A lithologically distinct series of bedded, quartzo-feldspathic sediments, here given the name Sickle series, rests unconformably on the pre-Sickle group of greenstone and associated rocks (Wasekwan series) and is the youngest Precambrian bedded group in the district." This series may be approximately equivalent to the Missi series found between Amisk and Kississing Lakes, which it closely resembles in appearance and lithology.

Rocks of the Sickle series are found in the Hughes Lake Area in a synclinal structure around Hughes Lake. The west side of the syncline is overturned to the east. A massive conglomerate forms the base of the series and passes upwards into arkose and greywacke. The conglomerate is resistant to weathering and in most places forms prominent ridges. Conglomerate is best exposed on the north and west sides of Hughes Lake and on the east side of Stan Lake.

The pebbles of the conglomerate consist of quartz, felsite, chert, granite, porphyry, and pegmatite. In a few places pebbles of diorite, sediments, and volcanics are found. The average size of pebbles is two to three inches, but some are a foot long. The larger individuals are quartz and granitic material. In many places the pebbles are slightly elongated. In parts of the conglomerate, pebbles make up 80 percent of the whole. The groundmass is a pink to grey to greenish arkose in which grains of quartz and feldspar are visible. In some places the groundmass is schistose with biotite and chlorite; in others it is fine, grey, and sericitic. Irregular spots of red iron oxide are scattered through the rock, and thin bands of black hematite indicate the bedding. Lenses of sand a few feet in length occur in the massive conglomerate. The elongation of the pebbles is at an angle to the strike as determined from the fine-grained beds.

On the west side of Hughes Lake, going up the section and across the strike, (to the east) the pebbles are assorted quartz, granite, chert, and felsite, then they become mainly light and dark chert and felsite with some quartz, and finally are mainly pink felsite. Beds of arkose appear until the rock becomes an arkose with occasional pebble beds.

The arkose is grey or brownish weathering with grains of quartz and feldspar an eighth of an inch across visible on the weathered outcrop, in places producing a rough surface. The fresh surface is dark grey. It is a massive rock with little evidence of bedding planes. On the west side of Stan Lake and southwest of Hughes Lake, a red phase of the arkose occurs. In thin section the color is seen to be due to much fine, red iron oxide. Scattered pebbles of quartz, half an inch across, are found in the arkose, and occasional pebble beds. On the small point on the west side of Hughes Lake, beds of dark grey greywacke and black argillite occur. Ripple marks, cross-bedding, and scour-and-fill structures are visible in these beds. All indicate tops of beds to the east.

Near the southwest corner of the area, a prominent mass of conglomerate has been highly sheared so that much of it is a streaked, light and dark green and pink rock. The dark green and pink areas probably represent pebbles. Some of the pink areas are quartz-feldspar porphyry. Quartz, aplite, and granite stringers cut this rock. At the south end of the bay to the east, the contact of conglomerate and granite can be seen. The granite is dark grey, hornblendic at the contact and intrudes the conglomerate.

West of Hughes Lake, contacts between conglomerate and granite, and conglomerate and dioritic material can be seen. The relationship is not clear, but there is a suggestion that the conglomerate is lying unconformably on older rocks.

At the north end of Hughes Lake an unconformity is indicated as the Sickle conglomerate is striking east-west and the Wasekwan volcanics are striking nearly north-south.

In the large outcrop on the west side of Stan Lake, near the southeast corner of the area, although there has been some contortion, the beds strike generally south and top to the west. Outcrops to the west show the sediments striking east and topping north. A rather sharp fold is indicated between these outcrops. Also there is some indication of an east-west fault near the south end of Stan Lake--approximately along the line of the creek between Stan and Gold Lakes. Such a fault with a vertical displacement would explain the disappearance of the Sickle sediments to the south and also the fact that no conglomerate appears between the arkose and the volcanics at this point.

MIXED ROCK

A large area in the central part of the map is shown as Mixed Rock. This area is a mixed assemblage of granite, altered volcanics, and diorite, believed to represent a granite batholith that has intruded and incorporated much of the country rock and granitized some of the inclusions. Some outcrops are entirely of one rock type, others contain several types. Some of the granite is probably an older granite on which lies the Sickle series in Hughes Lake. Within the area of mixed rock are shown bodies of granite. Most of the outcrops contain some inclusions, and the shapes of the bodies are quite indefinite. Some of these granite portions may be younger granite intruding the older mixed assemblage.

Other outcrops of mixed rock throughout the map-area represent intimate associations of rock types that cannot be separately indicated on the scale of the present map.

INTRUSIVE ROCKS

Intrusive rocks of several types and ages are found in the area. All are believed to be younger than the Wasekwan series. The sheared granite gneiss south of Cartwright Lake and much of the granite in the central part of the area are believed to be pre-Sickle in age. The granite in the northeast corner may also be an earlier granite. The grey granite south of Cartwright Lake intrudes Sickle rocks and therefore is younger.

The ages of the various diorite-gabbro bodies is not definite. The diorite of Hughes Lake is believed to be younger than the Sickle sediments. At least some of the bodies are older than the later granite as cross-cutting relations can be seen. A definite contact of granite intruding gabbro is seen on an outcrop one mile north of Bob Lake in the northern part of the area.

Porphyry, felsite, and aplite dykes intrude the Wasekwan rocks, and quartz stringers cut both Wasekwan and Sickle rocks. Lamprophyre dykes cut some of the gabbro bodies and may be later than the younger granite.

SHEARED GRANITE GNEISS

A sill-like body of granite gneiss lies between bedded tuffs of the Wasekwan series and a massive grey hornblende granite south of Cartwright Lake. The width of the gneiss is between 800 and 1,200 feet. It is a pink, white, and greenish streaked rock. Quartz appears as long narrow lenses. On the fresh surface the rock is slightly darker and in places quite schistose with chlorite and sericite. The rock probably represents an old sheared granite sill that has been subject to almost the same deformation as the Wasekwan series. Another possible origin is that the shearing has been produced by a strong east-west faulting. If this is so, the granite is not necessarily of pre-Sickle age.

DIORITE, QUARTZ DIORITE, GRANODIORITE, GABBRO, AMPHIBOLITE

Several bodies of basic intrusives occur within the area. These are mapped as units 8 and 9, and although all may not be of the same origin, it is believed that they form bodies separate from the larger granitic intrusives which also have dioritic phases. The shapes as indicated on the map may not be the true shapes, as they were inferred from the outcrops seen.

The body shown around the east end of Cartwright Lake is a fine-grained, green- to pink- to grey-weathering diorite and granodiorite with scattered blue quartz grains in places; all the other bodies in the area are dark grey, green, or black quartz diorite, diorite and gabbro. They are mapped as diorite unless otherwise determined, although several may be altered gabbro. Some show considerable quartz and are indicated as quartz diorite.

Thin sections of most of the basic bodies were examined. In most of the sections, the feldspar is highly altered to epidote and zoisite, and a determination of the variety was not possible. Andesine plagioclase was identified in a thin section of a specimen from a mile and a half southwest of Gap Lake. The quartz diorite north of Tulune Lake also contains andesine. Two thin sections from specimens of the Tulune Lake body showed labradorite, thus this rock is a gabbro. The ferromagnesian mineral in all the sections examined is now secondary amphibole.

The Tulune Lake gabbro body is variable in appearance and composition. In places it is dark, fine-grained, massive; in other places it is coarse-grained and gneissic. Feldspar content varies from about 20 to 60 percent. One feature noted in the western part of the body is the presence of numerous "basic segregations". These are small patches or lens-like masses of coarse hornblende, feldspar, and magnetite. Also in this part of the body are numerous quartz, aplite, and lamprophyre dykes. As the southeastern outcrops of the body show no dykes or basic segregations, it is believed that faulting with vertical displacement has raised the western part relative to the eastern part thereby exposing a lower horizon in the western part. The gabbro body has a quartz diorite phase in the southwest part, probably a contact effect of the younger granite to the west.

The quartz diorite to the north of the gabbro seems to be a separate mass. Although it has a small amount of gabbro at its southeastern end, it is more uniform in appearance than the gabbro. Granodiorite is a late phase of this body--even forming a breccia of quartz diorite fragments.

Diorite is found in many places in the large central area of mixed rock. Probably much of this is a recrystallization product of volcanic rock, although some is undoubtedly intrusive. Most of this diorite is cut by granite and aplite dykes.

GRANITIC INTRUSIVES

Granitic rocks ranging in composition from granite to diorite occur over a large part of the area. In places, shearing has produced sheared phases and even augen gneisses. This effect is believed to be relatively local rather than a feature common to all granites of a certain age. Some of the granite is known to be post-Sickle and post-basic intrusive; some is pre-Sickle. Of the several types of granitic rocks recognized, probably most are phases of one major period of intrusion.

In the northeast corner of the area the rock is in general a pink, medium-grained biotite granite. Diorite and quartz diorite phases are present but are not indicated on the map. In most places a slight degree of shearing is evidenced in the sugary texture of the quartz grains. In an outcrop southeast of Kay Lake, the rock has been sheared to such an extent that the quartz and feldspar form lenses surrounded by biotite, and it approaches an augen gneiss. In the southern outcrops of this northeast body, are numerous small inclusions of volcanic material. The granite is gneissic with foliation parallel to that of the volcanic rock and probably an inherited structure. The contact of the granite body and the volcanics to the south is gradational over a short distance rather than clear-cut.

The intrusive body shown north of Auni Lake consists of a white-weathering grey to greenish, medium-grained granitic rock. In general it is composed of plagioclase and amphibole, but one outcrop near the east side of the body shows considerable orthoclase. Quartz was seen in only two specimens, but three thin sections contain minor interstitial quartz which may have been introduced subsequent to the intrusion of the body. Biotite is present in a few places. In two outcrops at the eastern end of the body, the rock is gneissic. Only one outcrop west of Eagle River was seen. At this point the rock is a light colored diorite. This intrusive body may be classed as a syenodiorite with some granodiorite and diorite gneiss phases. Within the body are a few outcrops of altered volcanics, probably representing inclusions or roof pendants.

The relation of the Auni Lake body to the mass of granite to the north is not known. They are shown on the map as separate bodies although their borders approach closely and a swamp lies between them. The most southerly outcrop of the main granite body is not unlike the syenodiorite. However, it is granite on the eastern end and can be followed through a gradational contact into volcanics to the west, and so is believed to be a contaminated border phase of the granite.

In the northwest part of the area is a pink or grey biotite granite. In some places the quartz is sugary as though sheared, in others it is in blue grains. Some of this granite is a white-weathering high-quartz variety. The granite in the large hill northwest of Bob Lake contains a slightly greenish feldspar. A mile north of Bob Lake a light-weathering granite intrudes and forms a breccia of the gabbro. Some of the gabbro fragments have been granitized so that their outlines are hazy, and their composition is a quartz diorite.

The southeastern granite mass is medium-grained, grey to pink biotite granite which contains some inclusions of mica schist.

South of Cartwright Lake the intrusive body is mainly a grey, medium- to coarse-grained hornblende granite. In some places it is a quartz diorite and in others a diorite. Shearing is seen in outcrops along the north contact. This granite intrudes the Sickle series.

On the west side of Herman Lake three granites can be seen in one outcrop. One is a pink biotite granite low in ferromagnesians, one a grey hornblende granite which grades into a hornblende diorite, and one a grey slightly porphyritic granite. All are cut by pink aplite and pegmatite. The grey porphyritic type is cut by and forms inclusions in the grey hornblende granite. The relationship between the grey hornblende and the pink granite is not so definite. Contacts can be seen but seem to be gradational. The grey type contains more dykes than the pink type. In outcrops farther west, pink granite shows chilled borders against a hornblende diorite. In one outcrop on the west side of Muskeg Lake, gneissosity in grey granite stops abruptly at the contact with pink granite. These two granites may be phases of one major period of intrusion. The conclusion for this central area is that an early grey granite intruded and altered the country rock. Probably associated with this granite was some diorite. At a later period of intrusion granitic material, at first grey hornblendic types and later pink granite, cut through and incorporated much of the rock. This is now a complex area, especially as the various granite types cannot always be distinguished.

South of Muskeg Lake strong shearing is associated with a north-south fault. Strong shearing is also seen on the east side of the large island in the Hughes River north of Herman Lake. Several outcrops of granite west and south of Muskeg Lake show the results of shearing as a sugary texture of the quartz or as fine strings of chlorite surrounding quartz and feldspar. In a few places fractured feldspar crystals can be seen. In thin section, a grain of sugary quartz is seen to be made up of a mass of small individuals, believed to be the result of fracturing of the original grain. This evidence of shearing only appears in the high quartz varieties. In rocks containing considerable amounts of ferromagnesian minerals, slight shearing would be confined to these minerals and so would not be apparent in the rock in its present altered condition.

PORPHYRY AND FELSITE

Quartz-feldspar porphyry intrudes the volcanics east of the east bay of Cartwright Lake in the form of irregular dykes and small masses. The volcanic rock at this point is a rhyolite, some of which is also porphyritic, thus, unless an intrusive contact is seen, it is difficult to distinguish the porphyry intrusive from the rhyolite flow. Perhaps the dyke rock represents intrusive "feeders" of acid flows.

Intrusive quartz-feldspar porphyry on the south side of the east bay of Herman Lake may have a similar relationship with the acid volcanics to the south. To the east along the Hughes River an irregular mass of quartz porphyry and feldspar porphyry is intrusive into the volcanics. South of Narrow Lake a small body of felsite appears to have intruded Wasekwan rocks. Southeast of Key Lake massive, white-weathering feldspar porphyry intrudes altered pillow lavas.

Probably the porphyry and felsite rocks in the map-area are pre-Sickle in age. Pebbles of similar rock types are numerous in the Sickle conglomerate.

STRUCTURAL GEOLOGY

FOLDING

The structure in the Hughes Lake area is not clear. The Sickle sediments around Hughes Lake lie in a syncline which may be faulted at its southeast end. The southwest and west sides of the syncline are overturned to the east, so that the beds now dip to the west. Several determinations indicated tops of beds towards the centre of the lake.

In the Wasekwan series strikes of formations are uniform within a small section. They vary from east-west, south of Hughes Lake, to about N 40° E, northwest of Hughes Lake, to east-west and N 70° W in the northern section. Determinations of tops of flows were made in several places, mainly from shapes of pillow structures. All these indicated tops of flows to the north, with the exception of one doubtful determination south of Key Lake. Possible structural interpretations were discussed previously under discussion concerning the Wasekwan series.

Evidence of contortion and minor folding is seen in several places. Drag-folds were examined in several outcrops, but it is not possible to say whether these are related to major or to minor folds. On the evidence of drag-folds, an anticlinal axis is indicated somewhere south of a line passing through Cartwright Lake, Gap Lake, Gold Lake, and Stan Lake. In the northern belt of Wasekwan rocks, minor fold axes are indicated in one or two places.

FAULTING

Evidence of faulting in the Hughes Lake Area is widespread. Several topographic lineations trending north-south are clearly seen on the map.

One of the main lineations extends down Muskeg Lake and about three miles south of the lake. Throughout much of its extent, this feature is marked by scarps above a muskeg-filled valley. Furthermore, the rocks in the vicinity show contortion and shearing. North of Muskeg Lake several valleys suggest faults. One may extend northeast to Tulune Lake, causing vertical offset in the gabbro as previously mentioned. Four miles south of Muskeg Lake, an offset of the granite contact marks the continuation of the Muskeg Lake fault. There is some evidence that this fault has one or two branches extending southwest across Cartwright Lake. In the southwest corner of the area, the prominent ridge of conglomerate ends abruptly at the river, and the country north of the river is low. The river may mark approximately the location of a fault.

The upper part of the Hughes River probably follows a fault break, but apparent offsets are not consistent in direction or amount. Eagle Lake is believed to be a fault valley, although evidence of offsets was not found. Northeast of Auni Lake lineations and shear zones have a northeast trend. Shearing and north-south strikes of formations along the Hughes River northeast of Herman Lake may be caused by a continuation of one of these sets of faults.

The possibility of an east-west fault south of Hughes Lake has been discussed.

ECONOMIC GEOLOGY

The main activity in the Hughes Lake area in the past year has been the search for nickel-bearing ore-bodies. To date none have been located. Geophysical surveys were made on several properties, and the International Nickel Company did some diamond-drilling on the Tulune Lake gabbro body.

As nickel is known to accompany some basic intrusives, the most favorable localities for the occurrence of nickel is in the gabbro body of Tulune Lake, the "diorite" to the west along the Hughes River, or the "diorite" bodies shown in the south half of the map-area. None of the rocks in the bodies examined are exactly similar in appearance to the nickel-bearing gabbro of Lynn Lake, but several of the bodies have not been thoroughly prospected, so their true composition and the likelihood of the presence of nickel is not known.

Gold mineralization has been found in several places in the area. About 1934 several trenches were dug in the sediments on the east side of Muskeg Lake. These rocks are twisted and sheared, probably a result of the shearing which produced the Muskeg Lake fault. It is reported that free gold was found at these points.

South of Hughes Lake, Sherritt Gordon Mines Limited, did considerable diamond-drilling in 1947 in the search for gold. West of Gold Lake masses of "float" returned high assays in gold. This rock is a fine-grained schist. It varies from grey to green in color and is believed to be schistose volcanics, tuffs, and sediments. Quartz, carbonate, and pyrite have been introduced into the rock. In view of the fact that the rock is easily fractured and that it appears in large angular blocks, it was believed that the masses were "heaved" by frost action from material directly below. Diamond-drilling, however, failed to locate the gold-bearing shear zone. It is probable that the surface float originated a short distance to the north or northwest. Drilling on the east side of Gold Lake also failed to locate the mineralization found in surface outcrop.

On the east side of the southeast arm of Cartwright Lake, a dyke of pink, quartz-feldspar rock, in part a porphyry, in part an aplite, cuts the Wasekwan volcanics. The dyke averages 40 feet wide and is cut by a network of small quartz stringers, and in places is well mineralized with pyrite. This dyke, though much narrower, has been located on the west side of the bay. Outcrops of the rock have been found across a length of some 3,000 feet. From the present mapping it appears as though the dyke is slightly offset by a north-south fault in the bay. Since 1934 several mining companies have been interested in the property, and in 1940 Sherritt Gordon Mines did some diamond-drilling on the east side of the bay. Twelve trenches were dug at various points along the dyke, and samples have been taken by several individuals. The results of the assays of these samples show that the gold mineralization is in general of low value. A true estimate of the value of this body would not be possible without careful, thorough sampling, and preferably bulk sampling. In view of the indicated size of the dyke, a low-grade, large-tonnage operation might prove possible when the Lynn Lake district becomes developed.

In the area northeast of Herman Lake to the granite contact, are several shear zones carrying sulphide mineralization. As far as is known, any assays made have indicated only a trace of gold. However, more thorough prospecting in the region is recommended. The difficulty, as in many other places, is that much of the region is low and muskeg-covered, and outcrops are difficult to find.