CANADA

DEPARTMENT

OF

MINES AND TECHNICAL SURVEYS

---

GEOLOGICAL SURVEY OF CANADA

PAPER 45-14

# McVEIGH LAKE AREA
# MANITOBA

(REPORT, MAP, AND FIGURE)

By

J. D. Bateman

OTTAWA

1945

CANADA

DEPARTMENT OF MINES AND RESOURCES

MINES AND GEOLOGY BRANCH

GEOLOGICAL SURVEY

Paper 45-14

# MCVEIGH LAKE AREA, MANITOBA

By

J.D. Bateman

OTTAWA, 1945

CONTENTS

## Illustrations

McVeigh Lake Area, Manitoba

## INTRODUCTION

### Location and Field Work

McVeigh Lake area, situated in the Granville Lake mining division of northern Manitoba, has been the scene of a number of gold discoveries since 1938. The area contains one of the largest groups of surveyed claims owned by a single mining company in Canada. The area staked comprises one block of more than 350 surveyed claims and a smaller block of 67 surveyed claims, altogether covering about 33 square miles. These mining claims contain the most northerly gold discoveries in Manitoba on which any substantial development work has been done. Operations, which were suspended late in 1941, consisted of surface exploration and diamond drilling.

The field work on which the present report is based was undertaken in 1940, and was confined to a detailed study of the two staked areas and the intervening ground. As a result of this work, the early Precambrian rocks have been subdivided into stratigraphic units, and a relationship of the gold-bearing quartz veins to certain of the geological formations is demonstrated. The structure of these rocks and their geological environment present favourable conditions for the existence of commercial gold deposits in the district.

McVeigh Lake lies 114 miles north of Sherridon, the nearest railway station, and 33 miles east of the Manitoba-Saskatchewan boundary. The district may be reached conveniently by aircraft operating from Cold Lake or Channing, Manitoba. An alternative method of travel is by canoe from the village of Kississing by way of Kississing and Churchill Rivers and north through Granville Lake[1].

[1] Geol. Surv., Canada, Sum. Rept. 1933, pt. C, pp. 23-24.

The journey requires about 7 days.

The accompanying geological map covers the area staked, and comprises two arms that, in fact, reflect the principal structure of the area. The smaller block of claims on the south arm lies north of Lasthope Lake and is most easily reached by a trail 1½ miles long from the north shore of that lake. The claims on the south arm are intersected by the 23rd base line, which extends easterly from the Manitoba-Saskatchewan boundary. The larger block of claims comprising the north arm of the area mapped extends east and west from McVeigh Lake; most of these claims may be reached by way of trails that run in different directions from the Sherritt Gordon camp on the southwest shore of McVeigh Lake.

The claim surveys provided an excellent base for the map, and facilitated close control of the geological mapping. The south arm was mapped on a scale of 1 inch to 800 feet by a combination of plane-table surveys, taping the claims lines, and pace and compass traverses run at intervals of 400 feet between the claim lines. Localities of complex geology were mapped by plane-table surveys on a scale of 1 inch to 200 feet. As the north arm lies in thickly wooded country, plane-table surveys were not possible, except on the shores of some of the lakes and in clearings about the gold discoveries. The claims in this part of the area were mapped on a scale of 1 inch to 1,000 feet by pacing the claim lines and running pace and compass traverses diagonally between claim corners. In areas of economic interest more detailed mapping was accomplished by using picket lines that had been cut at intervals of 200 feet. All geological information was compiled on a base of 1 inch to 1,500 feet.

## General Character of the Area

The land surface of the area mapped is representative of much of the Canadian Shield; it consists of a gently warped plain that slopes gradually to the north and south. This plain has been dissected by subaerial erosion and the resultant surface later modified by glacial erosion and deposition. Rock ridges alternate with muskeg-filled depressions and small lake basins. More than half the area is covered with muskeg that supports a sparse, stunted growth of spruce. The ridges on the south arm rise as high as 250 feet above Lasthope Lake, but the local relief, as measured on the 23rd base line, is less than 100 feet. The timber on about one-third of the north arm and almost the entire south arm has, at one time or another, been destroyed by forest fires. The south arm is in country containing much deadfall and a thin second growth of jackpine, but most of the north arm supports a thick growth of spruce, with some jackpine and scattered birch on the uplands.

None of the spruce is greater than 12 inches in diameter at the base, and few trees exceed 6 inches. The larger timbers required for mining operations would have to be obtained elsewhere. There is no adequate source of hydro-electric power within or adjacent to the area, but there are ample reserves on Churchill River some 50 miles south.

## Previous Work

Detailed geological reconnaissance was begun in the Granville Lake district by J.F. Henderson in 1932, and continued by G.W.H. Norman in 1933. The results of this work are contained in Map 301A, Granville Lake area, and in the Summary Report of the Geological Survey for 1933, Part C. The western half of the Granville Lake district was mapped by D.L. Downie in 1935. All this work is incorporated in the east and west halves of the Granville Lake sheet (Maps 344A and 343A) published on a scale of 1 inch to 4 miles.

## Acknowledgments

The writer is indebted to Mr. Eldon L. Brown, general manager of Sherritt Gordon Mines, Limited, and to Mr. A.E. Gallie, the company's resident engineer at McVeigh Lake, for many courtesies and co-operation in the work. J.M. Harrison, L.E. Lynd, and H.A. Stubbs rendered capable and efficient service as field assistants.

## GENERAL GEOLOGY

### Summary Statement

All consolidated rocks in the map-area are of Precambrian age and in previous work have been classified as Archaean (Early Precambrian). Henderson and Norman established the existence of a volcanic and pyroclastic assemblage overlain unconformably by a series of feldspathic sandstones and quartzites with conglomerate at the base. Norman gave the name "Sickle" to the younger series and classified the older rocks as pre-Sickle. Both the Sickle series and pre-Sickle rocks have been folded complexly and are cut by various granitic intrusions.

The present report[1] deals with a small area that straddles

---

[1] A brief account of the geology together with a detailed discussion of the metamorphic alteration of the rocks has previously appeared. See: Geology and Metamorphism in the McVeigh Lake Area, Northern Manitoba, by J.D. Bateman: Amer. Journ. Sci., vol. 240, 1942, pp. 789-808.

---

the boundary between the east and west halves of the Granville Lake map-area. This small area is underlain chiefly by a thick-folded section of pre-Sickle formations. No evidence of a marked unconformity has been observed within the pre-Sickle rocks, and the term "Wasekwan series" has been applied to them from their typical exposures on Wasekwan Lake. The Wasekwan series is probably of Archaean age, but the nature of the unconformity between it and the Sickle series suggests that the latter may be much younger.

The geological succession indicated for the area mapped is as follows:

Table of Formations

| | |
|---|---|
| PRECAMBRIAN | |
| Post-Sickle | Dyke rocks; syenite; granodiorite; trondhjemite; oligoclase quartz diorite, oligoclase diorite, quartz diorite, diorite; gneissic equivalents |
| Sickle series | Feldspathic sandstone and quartzite; conglomerate; derived schists |
| | Unconformity |
| [1]Post-Wasekwan | Sheared quartz-oligoclase gneiss, quartz porphyry; sheared "quartz-eye" granite-gneiss; metadiorite, metagabbro, amphibolite |
| Wasekwan series | Assemblage of altered basic lavas, pryoclastic rocks, and derived schists, alternating with feldspathic quartzites and stratified gneisses |

[1]The age of the post-Wasekwan intrusive rocks with respect to the Sickle series is not definitely known, but the deformation of the intrusions is unlike that of the Sickle series and corresponds with the folding of the Wasekwan formations.

The detailed subdivision of the Wasekwan series is summarized in the following stratigraphic table; the oldest formations being at the bottom:

Stratigraphic Summary of the Wasekwan Series

| Division | Lithology | Thickness Feet |
|---|---|---|
| H | Amphibolite and hornblende schist derived chiefly from basaltic pillow lava; minor associated tuff; narrow interbeds of impure quartzite | 1,500 |
| G | Impure (biotite-bearing) quartzite, altered porphyritic andesite, andesitic tuff; impure quartzite | 1,500-3,700 |
| F | Hornblende schist and gneiss, amphibolite (in part, straitform), derived from basic extrusives, tuff, and breccia; minor impure quartzite | 3,800 |

| | | |
|---|---|---|
| E | Amphibolite and hornblende schist derived from amygdaloidal pillow lava; minor andesitic breccia | 900-9,000 |
| D | Biotite-bearing quartzite inter-stratified with hornblende schist and gneiss, representing basic flows and lenses of stratified tuff | 500-1,200 |
| | Stratified quartz-albite gneiss | ? |
| | Hornblende schist (tuff) with thin ribbon-like interbeds of felds-pathic quartzite | 140 |
| | Dense, white, thinly laminated felds-pathic quartzite | 60-260 |
| | Buff, thinly bedded hornblende-biotite-bearing feldspathic quartzite | 140-300 |
| C | Green, stratiform amphibolite | 140-800 |
| | Magnetite-rich quartzite | 0-80 |
| | Dense, pink, thinly laminated, microcline-bearing quartzite | 0-160 |
| | Grey, thinly bedded impure quartzite | 0-40 |
| | Quartz-oligoclase-biotite augen-gneiss | 5-240 |
| | Amphibolite derived from basic ex-trusives and associated contem-poraneous metagabbro | 80-400 |
| | Thinly interbedded grey and pink quartzite | 100-500 |
| B | Amphibolite and hornblende schist (greenstone), locally stratiform; minor impure quartzite | 1,600 + |
| | Amphibolite and hornblende schist inter-stratified with andesitic tuff and breccia | 500 + |
| A | Thinly stratiform feldspathic gneiss | 300-500 |
| | Andesitic breccia | 1,200 + |

The eightfold subdivision of the Wasekwan series is based on lithology. No evidence of an important unconformity was observed within the series, and the steeply dipping formations lie one upon the other with contacts that, in part, are marked by gradational lithologic changes. In general, each of the divisions is distinctive, but in detail there are many lithologic similarities. Five of the divisions are predominantly volcanic, and in two of these (A, F) pyroclastic material is the chief constituent. Three of the divisions are dominantly sedimentary in origin, but two of these (D, G) hold much tuffaceous material.

The contacts of Division E with D to the south and F to the north are gradational on the Faust and C.L. claims, where they cannot be located closely with any degree of assurance. Within any of the divisions a wide variety of lithologic types of lavas, pyroclastic rocks, and sediments may be recognized. None of these types can be traced for any great distance, and individual members appear to be in the form of irregular lenses and local beds. Any attempt to map them separately would be an endless task as the lithology may change at intervals of less than 10 feet across the strike. This is indicated by detailed studies in the vicinity of some of the gold discoveries. Division C on the south arm of the area mapped is exceptional in that the nine distinctive lithologic units of which it is composed can be traced for considerable distances. The gold-bearing quartz veins are here confined to one of these units.

The Wasekwan divisions can, in general, be recognized with little difficulty, and in the process of field mapping a folded structure was disclosed. This structure is a westerly pitching anticline with the axial plane dipping north, and the trace of the fold axis passing through Franklin, Foster, and Wasekwan Lakes. Repetition of strata in the northwest corners of the Faust and Ace claims indicates a syncline. The oldest formations are not known, as they have been cut off by granitic intrusions northeast of the south arm. After discounting thickening of the formations as a result of minor folding and included intrusive rocks, the total exposed thickness of the Wasekwan series is in excess of 18,000 feet.

Post-Wasekwan intrusions (10, 11)[1] have been involved in the folding of the Wasekwan series, and may well be of pre-Sickle age. The largest of these is a folded sill of granite-gneiss lying between Divisions C and D.

Only two small outcrops of Sickle rocks are present in the area mapped, but the series is well exposed to the south in a syncline passing through Lasthope Lake. It is repeated in the syncline over a total width of 4 miles, but no valid estimate of thickness can be made as the rocks are intricately folded on a minor scale. The unconformity between the Sickle and Wasekwan series is drift covered in the map-area, but on the south arm the Sickle series appears to lie on Division C of the Wasekwan series with no indication that Divisions D to H, corresponding, approximately, to 12,000 feet of Wasekwan beds, are present.

Norman[2] has suggested that the relationships between the

[1] Numbers in brackets refer to map-units in the map-legend.

[2] Geol. Surv., Canada, Sum. Rept. 1933, pt. C, pp. 26-27.

Sickle series and pre-Sickle (Wasekwan series) rocks resemble those between the Missi series and Wekusko group between Amisk and Wekusko Lakes in northern Manitoba and Saskatchewan. He did not imply a close correlation between them, although suggesting that the Missi and Sickle series may be of the same general age. The Missi series is lithologically identical to the Sickle series, and subsequent geological work by the writer near Flin Flon confirms Norman's suggestion.

The Wasekwan series is cut by granitic intrusions (14) and, in places, is bounded by gneisses of similar composition (13) that cut the formations in directions that are slightly transgressive. The writer has not observed these intrusive rocks in contact with the Sickle series, but on the basis of comparative deformation and the relationships indicated elsewhere in the Granville Lake map-area (Map 344A) they are classified tentatively as post-Sickle.

## Wasekwan Series

Division A. The oldest formations of the Wasekwan series (1) are exposed north of the northeast corner of the Oro claims. The rocks consist chiefly of a pyroclastic assemblage bounded by intrusive granitic gneisses. Their estimated thickness of 1,200 feet is, therefore, a minimum. The formations strike northwest with dips about vertical. Locally these rocks are strongly deformed and contorted.

The lower 400 feet (1a) consists almost entirely of dark greenish grey, volcanic breccia composed of elongate fragments in a tuffaceous matrix. Dark grey fragments, which constitute about 60 per cent of the rock, are deformed into cigar-like shapes, the longest dimension pitching northwest at angles of 60 to 70 degrees from the horizontal. The matrix is coarser grained and dark green. The mineral composition of the rock is entirely reconstituted, and consists of small white grains of sodic andesine in a groundmass of hornblende with a small amount of biotite. The feldspars weather in relief, and give the rock a white spotted appearance. The original mineral composition of the rock cannot be determined, except in so far as it would appear to correspond to that of andesite or basalt.

Stratigraphically above the breccia (1a), and separated from it by a sharp conformable contact, is 300 to 500 feet of fine-grained, thinly bedded, sedimentary gneiss (1b). This rock consists of alternating pale green and grey, feldspathic layers. Stratification has been obliterated locally by metamorphism, and the feldspars have re-formed as small crystals. Thin zones of light-coloured breccia, basalt, and basic tuff are interbedded with the more gneissic rocks, suggesting that the latter were derived from tuffs, and that their composition was somewhat more siliceous than andesite.

A mixture of amphibolite and hornblende schist with tuff and breccia (1c) forms the upper 500 feet of the division. The rocks weather light to dark green and are, in part, stratiform. They have been contorted, and some of the breccia fragments have been squeezed to such an extent that the rock appears bedded. Secondary biotite is common on foliation planes of the schists, and the more massive rocks are characterized by small white grains of feldspar that give them a pepper and salt texture.

Division B. A greenstone assemblage (2) extends northwest through the northern claims of the Oro group to the east shore of Wasekwan Lake. The greenstones are separated from the rocks of Division A by granitic gneisses, and have been invaded by similar intrusions on the north and east. The total stratigraphic thickness exposed is in the neighbourhood of 1,600 feet, but this figure may be subject to some reduction owing to the possibility of unrecognized minor folds. The southeasterly exposures dip steeply south, but a short distance northwest the greenstones are vertical, and farther north they dip steeply to the northeast and east.

The greenstones consist chiefly of fine-grained varieties of amphibolite and hornblende schist. Such rocks are well exposed east of Wasekwan Lake. In the vicinity of the Wiley Lakes they are stratiform and may be of tuffaceous origin. On the Oro claims numerous narrow beds of fine-grained, biotite-bearing quartzite and cherty quartzite are interbedded with the dark green schists. In general, the greenstones, except for the stratiform varieties, resemble basic lavas, but they do not exhibit ellipsoidal or amygdaloidal structures common in such rocks. Weathered surfaces are bleached, but fresh surfaces are dark green and, locally, exhibit small white grains of secondary feldspar. Small grains of secondary amphibole make up from 40 to 65 per cent of the rock, with subordinate amounts of feldspar that ranges from sodic oligoclase to calcic andesine. Epidote and biotite are minor constituents and, in some instances, the amphiboles are pale and actinolitic. There is no remnant of the original fabric of these rocks, whether massive or schistose, and they are thought to be the metamorphic derivatives of basaltic lavas.

Division C. An assemblage of fine-grained, bedded rocks (3) extends northwest through the south arm of the mapped area, and along part of the south border of the north arm. The southwest side of this belt is bounded by intrusive granitic gneisses, and on the northeast side the lower part rests on the rocks of Division B. The contact between the two divisions (B and C) is sharp, and where mapped in the vicinity of the Wiley Lakes appears to represent a slight angular discordance.

The maximum thickness of Division C is probably in excess of 3,500 feet, but no reliable figure can be reached as the greater part of the area underlain by these rocks is covered with drift and muskeg. South of the 23rd base line the beds dip steeply southwest; elsewhere they dip to the northeast and north. On the southern block of claims, Division C is separable into eleven distinct units, at least ten of which are bounded by sharp, conformable contacts. The sedimentary varieties exhibit two types of stratification. One of these is an interbedding of coarse and fine, sandy material, and the other is a fine lamination in feldspathic, cherty quartzites.

The basal member of the division (3a) is best exposed southeast of Foster Lake, in the vicinity of the Wiley Lakes, and on the southern block of claims. It consists of 100 to 500 feet of interbedded pink and grey quartzite in beds about an inch thick. The grey quartzite is a medium-grained sandy variety containing biotite and small, scattered grains of magnetite. The pink interbeds are of fine-grained, feldspathic, cherty quartzite. They are resistant to weathering, and this feature produces a detailed relief on outcrop surfaces.

To the southwest, and stratigraphically above the pink and grey quartzite, is 80 to 400 feet of fine- and coarse-grained amphibolite (3b). The coarse-grained variety is intrusive in the finer grained equivalent, cutting it along transgressive contacts. The intrusive amphibolite is interpreted as a metagabbro. It is not found in the overlying rocks, but has been observed in the underlying member (3a). The amphibolite is dark green and, in places, on the weathered surfaces is bleached almost white.

The texture of both varieties of amphibolite is secondary, and in the coarse-grained type the amphibole forms large metacrysts with the typical sieve structure of secondary hornblende. Untwinned sodic andesine, and small amounts of clinozoisite, biotite, and, in the coarse-grained variety, apatite are present in addition to the amphibole. The fine-grained varieties are commonly schistose, and are thought to be basic flows, whereas the coarse-grained variety is probably an approximately contemporaneous basic intrusive.

A medium-grained, grey gneiss (3c) lies southwest of the amphibolite (3b), and ranges in thickness from 5 to 240 feet. The gneiss is an augen variety in which the quartz has been thoroughly crushed and granulated, and the feldspars less so, resulting in lenticular unreduced residuals that give the rock an eye-like or 'augen' texture. Quartz and untwinned oligoclase are the chief constituents, making up more than 75 per cent of the rock. Greenish biotite is the principal dark mineral, and epidote, carbonate, and apatite are present in small amounts. The origin of this rock is obscure, although the gneissic structure is certainly due to deformation. Whether igneous or sedimentary it can be mapped as a stratigraphic unit, and the contacts with adjacent formations are sharp.

A series of quartzitic beds (3d), not everywhere present, consists, at the base, of up to 80 feet of coarse-grained, grey, bedded quartzite in which the beds vary in thickness from a fraction of an inch to 3 inches. Narrow, chert-like beds are common in the member, but most of the rock is sandy and contains fine, scattered crystals of magnetite and garnet. Above the grey quartzite is a dense, pink, finely laminated quartzite that is up to 160 feet thick. It has a chert-like texture, in part produced by granulation of the constituent minerals. The rock consists chiefly of quartz with microcline and subordinate albite-oligoclase arranged in a fine secondary foliac. Overlying the pink quartzite is a magnetite-bearing quartzite that is up to 40 feet thick. The magnetite forms grains in the quartz and, although it does not appear to be abundant, the rock exerts a strong magnetic attraction on the compass. The attraction is quite local and, in drift-covered areas, the position of this rock can be closely determined. The quartzite bears little resemblance to iron formation, and the magnetite is probably of detrital origin.

One of the most prominent formations on the south arm is a stratiform amphibolite or hornblende schist (3e) that is best exposed on the ridge north of the centre line of the Smoke claims. Wherever exposed, this rock underlies the crest and flanks of a ridge and, although thoroughly schistose, it has offered a greater degree of resistance to erosion than the adjacent quartzites. Its thickness ranges from 140 to 800 feet. The rock is bright green on both fresh and weathered surfaces. Individual layers cannot be followed for more than a few feet. Some of them have a fine-grained, clastic texture and are interbedded with a few thin basaltic schists and narrow breccia zones. The association suggests a tuffaceous origin. A characteristic feature is the presence of local lenses, streaks, beds, and "knots" of lighter coloured material. Shear zones 1 to 3 feet wide are common, and strike at various angles to the bedding. Locally the rocks are drag-folded, contorted, and intersected by numerous, small faults that commonly have a horizontal displacement of less than a foot. The rock consists of secondary hornblende and untwinned sodic labradorite in a ratio of about 4 to 1. In a few places biotite is an important constituent. The secondary hornblende is altered to chlorite along narrow shear zones.

Those formations of Division C older than the last described unit (3e) underlie the northeast flanks of a series of ridges, whereas those stratigraphically above it underlie the southwest flanks. The first of the latter group, a grey to buff, impure, feldspathic quartzite (3f), is of particular interest, as the gold-bearing quartz veins in the southern block of claims are confined to it. Most of the quartzite is thinly bedded, and is composed chiefly of feldspar and quartz, with more or less hornblende, biotite, magnetite, and garnet. A few thick, chert-like beds are present, but most of the material appears to comprise sandy sediments with fine interbeds of silty material. In a few places, as on the north half of claim D.N. 1, lenses of tuffaceous schists are interbedded with the sediments. These schists consist of comminuted albite, with amphibole, quartz, and biotite. The entire formation is from 140 to 300 feet thick, and commonly has a gneissic appearance. In many places small lenses of quartz, mostly less than 2 inches long, have filled fractures parallel to the bedding. Over considerable areas a secondary fracture system has formed at an angle of 35 degrees to the strike of the bedding. These fractures are also filled with quartz, with the net result that the rock has an unusual appearance somewhat resembling a herringbone pattern, a feature alone sufficient to distinguish this quartzite member from any of the others.

Except for these features, however, the rocks of this member (3f) exhibit many differences, particularly in the proportions of the constituent minerals, from place to place. Feldspar locally predominates over quartz, and although hornblende may be present in appreciable amounts it is generally subordinate to biotite. The formation of granulated textures by crushing of the minerals is local, and is generally accompanied by the development of sericite, chlorite, and carbonate.

A dense, white, laminated, feldspathic quartzite (3g) from 60 to 260 feet thick lies to the southwest of the last described grey quartzite (3f). The rock is light grey to white, and has a chert-like appearance. It consists almost wholly of quartz with a little feldspar and lesser amounts of biotite and sericite. The feldspar ranges from albite to oligoclase.

Hornblende schist (3h) lies stratigraphically above the white quartzite, and has a thickness of at least 140 feet. The total thickness cannot be estimated as outcrops are everywhere overlapped by drift on the south. A characteristic feature of the formation is the presence of beds of fine-grained, white, feldspathic quartzite at intervals in the hornblende schist. The quartzite beds range from 1 inch to 2 feet in width and consist of quartz and oligoclase in a ratio of 2 to 1. The hornblende schist is a dark green rock composed chiefly of small grains of secondary hornblende with untwinned oligoclase and a little biotite. It is probably of tuffaceous origin. The quartzite interbeds constitute less than 5 per cent of the formation.

The uppermost member (3i) of Division C consists of medium-grained sedimentary gneisses of unknown thickness. They occur mainly as isolated outcrops in a large drift- and muskeg-covered belt. Where observed on the southwest shore of Wasekwan Lake the gneisses are bounded by granitic intrusions, and are altered considerably as a result of contact metamorphism. The gneisses are well exposed on the 23rd base line where it crosses Smoke 12. There they consist of medium- to fine-grained, bedded rocks, but the bedding is in most places masked by metamorphism. The gneisses weather buff, and consist chiefly of quartz and oligoclase or andesine feldspar. Hornblende, biotite, clinozoisite, and epidote are also important constituents. Locally the quartz and feldspar are granulated. Similar gneisses are exposed on the southwest shore of Wasekwan Lake. There the rocks are well bedded, but have undergone considerable alteration by adjacent granitic rocks and as a result resemble the nearby intrusions mineralogically except that the plagioclase in the former is more sodic in composition. The gneisses are medium-grained rocks and have crushed textures. They are composed chiefly of albite-oligoclase and quartz with accessory hornblende and biotite.

Division D. The rocks of this division (4) as well as those of succeeding Wasekwan formations, do not outcrop on the south arm of the area mapped, as they have been cut off by granitic intrusions adjacent to the axis of the principal anticline. The division consists of a mixture of hornblende schists and gneisses with impure quartzites and has a total thickness of 500 to 1,200 feet. Most of the gold-bearing zones on the north arm occur in this assemblage. The different strata have an easterly trend, but swing to the southeast on the Ace claims. Local deformation in the latter locality and east of Wasekwan Lake, where the rocks are much drag-folded, has resulted in a greater apparent thickness. The rocks are separated from those of Division C by a sill of granite-gneiss that appears to have been intruded along the contact. The contact with rocks of Division E is gradational and is possibly repeated by minor folds.

Detailed mapping of these rocks on parts of the C.L. and Faust claims (Figures 2B and 2C) shows that individual rock types do not comprise uniform beds, but occur rather as lenses of interbedded sedimentary and tuffaceous material. Some andesitic and basaltic types of flows were observed in a few places.

The tuffaceous rocks consist of varieties that weather dark grey to green and are generally schistose. The structure in the gneissic varieties is generally the result of an inherited stratification. Hornblende is commonly the principal mineral constituent, although in some of the tuffaceous varieties plagioclase feldspar, ranging from sodic oligoclase to andesine, or even epidote, is dominant. Secondary biotite is common in most varieties, and recrystallized textures that formed subsequently to the development of the schistosity are the general rule. In local zones these rocks have degenerated by crushing to finely granulated gneisses and schists, the plagioclase feldspars being more sodic than in the adjacent rocks that have not undergone shearing, and the hornblendes and biotites more completely replaced by chlorite.

The andesitic types are, on the whole, remnants of massive rocks with original porphyritic textures. These rocks weather grey to pea-green, are grey on the fresh surface, and contain small feldspar crystals that range in composition from albite to sodic andesine. The groundmass of these rocks consists mostly of hornblende and actinolite, but both the feldspars and amphiboles have been partly replaced by clinozoisite, chlorite, and carbonate.

The sedimentary types are compact, crystalline rocks in which quartz is generally predominant, and biotite the principal ferromagnesian mineral. Such rocks are grey weathering and indistinctly bedded. Certain rocks of doubtful origin are present that may have been normal sediments or tuffs. In these albite, oligoclase, or even secondary andesine predominate over the quartz, and minor constituents are hornblende, clinozoisite, and biotite.

The heterogeneous character of the lithology of Division D may be illustrated by the following rock determinations made in a cross-section from south to north in the northwest corner of claim C.L. 7:

| | Thickness Feet |
|---|---|
| Oligoclase-hornblende schist (metabasalt) ... | 50 |
| Biotite-bearing quartzite .................. | 10 |
| Amphibole schist (basic tuff) .............. | 6 |
| Biotite-bearing, feldspathic quartzite ...... | 3 |
| Quartz-amphibole gneiss (tuff?) ............ | 9 |
| Albitite dyke ............................. | 12 |
| Stratified biotite-hornblende-plagioclase-quartz schist; tuff ..................... | 33 |
| Oligoclase-quartz-hornblende gneiss (the plagioclase in some specimens is replaced by albite, in which case the hornblende is partly altered to chlorite) ............... | 10 |
| Albite-amphibole-quartz gneiss .............. | 9 |
| Sericite-biotite quartzite .................. | ?[1] |
| Quartz-hornblende schist partly sheared to form a crushed chlorite-quartz schist ..... | ?[1] |
| Hornblende-biotite-bearing quartzite ........ | ?[1] |
| Biotite-quartz-hornblende schist ............ | ?[1] |

1 Not measured.

The rocks of Division D south of McVeigh Lake exhibit an equal diversity and are separable into six or more varieties in which hornblende, quartz, or biotite is dominant. An inherent stratification may be seen in about half of the rocks, and the remainder appear to owe their gneissic or schistose structures to deformation. The development of recrystallized textures has followed the formation of the schistosity, but along narrow shear zones these secondary minerals have been crushed and replaced by micaceous ones. The gold-bearing quartz veins occur in zones of this type, and are associated with carbonatization of the rocks in the shear zones. On the Faust 3 claim a diamond drill hole through one of the gold-bearing zones intersected the following rock types, from north to south, over a length of approximately 100 feet:

Carbonatized quartz-hornblende schist

Carbonatized quartz-chlorite-hornblende schist

Finely granulated, carbonatized chlorite-quartz schist associated with vein quartz

Albite-quartz-biotite schist

Quartz-oligoclase-hornblende gneiss

Elsewhere, on the Dave, C.L., Faust, and Ace claims, the rocks of this division consist chiefly of plagioclase, biotite, hornblende, or quartz, but generally these minerals are replaced by abundant clinozoisite, epidote, and carbonate. Where this alteration is extreme epidote or carbonates may be the principal constituent of the rock. The composition of the plagioclase feldspars has a wide range from albite to labradorite, and, commonly, does not appear to bear any relation to that of the feldspar in the original rock, but seems to be determined by the character of the metamorphism and degree of hydrothermal alteration. Carbonatization invariably accompanies or follows granulation or crushing of the rock minerals, and both these conditions are found in the country rock of the gold occurrences. Epidotization is equally widespread, but is no more common in the wall-rocks of the gold-bearing quartz veins than elsewhere.

Some of the sedimentary rock types in which quartz is the chief constituent (the impure quartzites) may have been derived from greywacke. Others that are rich in feldspar cannot ordinarily be distinguished from feldspathic tuffs.

Division E. The rocks of this division (5) consist chiefly of massive amphibolite and hornblende schist that underlie most of the Dave claims and extend westward into the Ace claims as a much narrower belt. The apparent thickness is from 900 to 9,000 feet, but this latter figure may be exaggerated owing to undisclosed minor folds. Contacts with the members of other divisions to the north and south are gradational. On the Dave claims these rocks consist of a montonous succession of coarse- and fine-grained greenstones that weather pale to deep green and are dark green on fresh surfaces. The coarser grained phases are massive and, in many instances, can be traced with imperceptible gradations into finer grained schistose phases that commonly exhibit amygdaloidal and pillow structures. A large part of this division consists of amygdaloidal pillow lavas such as are common in basaltic effusive rocks. The coarser grained phases represent the central parts of the flows, although some of them may represent related basic intrusions.

The textures of both the massive and schistose types are the result of recrystallization processes, but the coarse-grained varieties commonly display inherited remnants of a diabasic texture. In both types hornblende and plagioclase feldspar are the principal constituents. Locally the hornblendes are replaced by actinolitic amphiboles, epidote, and chlorite. The composition of the plagioclase ranges from labradorite to albite, depending on the degree of alteration.

A belt of breccia, from 100 to 300 feet thick, extends eastward from the north boundary of Faust 33 claim, through Faust 27, 9, 1, and 2 claims, and northeastward through Faust 8, 19, 20, and 30 claims. The breccia consists of small, squeezed fragments in a tuffaceous matrix. The fragments are somewhat lighter coloured and finer grained than the matrix, and contain small feldspar phenocrysts. Both are mineralogically similar and consist chiefly of secondary albite with subordinate hornblende and biotite, and minor epidote and carbonate.

A narrow belt of fine-grained, impure quartzite in the amphibolite extends northeast through the north end of Wasekwan Lake, following the north boundary of the C.L. claims and its extension into the Dave claims. The quartzite weathers buff, is indistinctly bedded, and in addition to quartz, contains variable amounts of sericite, biotite, and chlorite.

Division F. A group of rocks (6) comprising hornblende schist and gneiss, amphibolite, and minor sedimentary beds, extends westward from the southwest bay of Cockeram Lake through McVeigh Lake to the west boundary of the map-area. These rocks constitute a section approximately 3,000 feet thick, and commonly form ridges somewhat higher than those underlain by adjacent formations.

The greater part of the division consists of interbedded, thin, basic flows and tuff. A little quartz-rich sedimentary material and volcanic breccia is also present. In the south bay of Cockeram Lake and near the northwest corner of the Dave claims the rocks consist of alternate beds of tuff and basic flows, most of which are less than 20 feet thick. The tuffaceous beds are, in part, stratified and weather light green in contrast with the darker schistose flows. No single bed can be traced for more than 200 or 300 feet. On the Dave claims the tuffaceous types consist chiefly of actinolitic amphiboles with epidote, oligoclase, clinozoisite, and carbonate. The minerals are arranged in a fine, parallel foliation. Locally 75 per cent or more of the rock may consist of epidote or clinozoisite. Where clinozoisite is predominant the rock is buff or even yellow, although the chemical composition may approach that of a basalt. Large crystals of secondary amphiboles occur in a fine-grained, light green, epidotized groundmass. Rocks with these features are abundant on the Faust and Ace claims, where they are composed of hornblende in a fine-grained groundmass consisting of a matte of amphiboles, untwinned oligoclase, biotite, clinozoisite, and quartz. In some places large grains of feldspar are present and range in composition from almost pure albite to calcic oligoclase.

The basic flows of this division are commonly more massive than the tuffs and, occasionally, are amygdaloidal. These rocks are composed principally of secondary hornblende in small grains, sodic plagioclase, and a little clinozoisite, epidote, and quartz.

A few narrow sedimentary beds are intercalated with the volcanic rocks, particularly on the Ace claims. These are fine-grained, indistinctly bedded rocks consisting chiefly of quartz with minor sericite, amphibole, and sodic plagioclase.

In the vicinity of the gold discoveries on the boundary between Ace 14 and 36 claims, there occur stratiform feldspar-rich rocks of doubtful origin. Greenish weathering varieties are recrystallized biotite-hornblende-quartz-oligoclase schists and may be of pyroclastic origin. Others, composed chiefly of quartz with subordinate biotite and untwinned feldspar, may be altered sedimentary material. Where the basic rocks are metamorphosed by granitic intrusions, as on the north boundary of Faust 5 claim, they are composed of about equal parts of secondary andesine and hornblende.

Division G. A group of light-weathering rocks (7), from 1,500 to about 3,700 feet thick, extends northeast through the northern Ace claims and part of the northern Faust claims. Where exposed, its contacts with rocks of underlying and overlying divisions are sharp. The constituent formations dip to the north, and somewhat more steeply than the older formations to the southeast. The volcanic rocks (7a, mainly) comprise grey weathering, porphyritic flows and stratified tuff, both of which are mineralogically similar. They are composed chiefly of plagioclase feldspar that ranges from untwinned albite through oligoclase to andesine in different specimens examined. Other important constituents are quartz, hornblende, and biotite.

Rocks mapped as impure quartzite (7b) outcrop on both the Faust and Ace claims. They consist of dense, grey, stratified sediments containing a little biotite. Similar rocks are found in the southwest Ace claims.

Division H. The youngest rocks of the Wasekwan series (8) strike northeasterly through the northwest claims of the Ace and Faust groups. North of a line between the southwest corner of Faust 147 and Ace 50 claims the rocks dip to the south, and the repetition of some beds suggests a synclinal axis passing through this section. The minimum thickness is, therefore, estimated at 1,500 feet. The rocks consist chiefly of amphibolite and hornblende schist that exhibit ellipsoidal and amygdaloidal structures common to basic extrusions. The pillow lavas have, however, been deformed and, in places, pillows have been flattened to resemble stratification and cannot be distinguished from tuffs of similar composition. The longest axes of the stretched pillows pitch southwest at an angle of 70 degrees. Minor beds of impure quartzite are intercalated with the volcanic rocks. The latter are schists consisting principally of hornblende with andesine or oligoclase. Similar rocks outcrop in the southwest corner of the Ace group of claims.

## Post-Wasekwan Intrusive Rocks

Some of the deformed and metamorphosed intrusive rocks that cut the Wasekwan series may be of pre-Sickle age. The evidence is not based on contact relationships with the Sickle series, for such contacts have not been found, but on the observation that the intrusions classed as "post-Wasekwan" have undergone more deformation and metamorphism than have the Sickle rocks in the map-area. Where these intrusive rocks occur in the Wasekwan series, the planes of schistosity pass from one rock to the other without deviation, and both types seem to be, otherwise, about equally deformed.

Altered Diorite Porphyry, Amphibolite, Gabbro. Basic intrusions of probable pre-Sickle age (9) are not common in the Wasekwan series. One of the few small bodies observed outcrops on the Dave 49 claim, and is a mass of medium-grained, altered diorite porphyry (9a). The texture of the rock is recrystallized, with oligoclase metacrysts in a groundmass of hornblende with subordinate carbonate, epidote, and quartz.

A small mass of amphibolite near the east corner of Smoke 16 claim (9c) may be intrusive; neither its structural nor its genetic relationship to the adjacent formations is known.

A larger body of a medium-grained basic intrusive rock (9b) lies north of the Ace group of claims. This rock is locally schistose, but presents a massive appearance in outcrop. Miscroscopic examination shows it to be an altered gabbro composed of calcic plagioclase and an amphibole that may be hornblende or actinolite, locally replaced by chlorite. The rock is green weathering and grey-green on the fresh surface. Where least altered it is composed of an estimated 70 per cent bytownite ($Ab_{18}$-$An_{82}$) and 30 per cent actinolite. Where subjected to more metamorphism the feldspar is altered to labradorite and the ferromagnesian mineral to secondary hornblende. Where the rock has undergone most alteration the feldspar is andesine.

Sheared Granite-gneiss. A narrow belt of pink granite-gneiss (10a) extends across the southern claims of the north arm of the area, and is intruded between the older rocks of Divisions C and D of the Wasekwan series. This body has been traced for about 10 miles, and has been followed around the nose of the fold at Franklin Lake. Its extension to the southeast, west of Wasekwan Lake, is overlain by muskeg and sand plains. The average thickness of the granite-gneiss is in the neighbourhood of 200 feet, but it has a much greater apparent thickness southeast of Franklin Lake.

The gneiss is clearly intrusive into the enclosing formations, and narrow dykes of it may be seen in rocks of Divisions C and D near the contacts of the granite-gneiss with these formations. The body is a sill that conforms exactly to the borders of the enclosing formations, and is presumed to have been folded with them. It is well exposed in many places on the south flanks of ridges, where it weathers deep pink. Close examination shows that it is a powerfully sheared granite composed principally of pink feldspars and quartz that have undergone considerable crushing.

Quartz Porphyry. Small bodies of an altered quartz porphyry (10b) occur in the southwest claims of the Ace group. They show transgressive contacts with adjacent formations of the Wasekwan series, but planes of schistosity pass from the intrusive to the enclosing rock without deflexion. The porphyry has been involved in the folding with the Wasekwan series. It is grey, and characterized by crushed quartz phenocrysts and small flakes of biotite in a very fine-grained, light-coloured, comminuted groundmass.

Sheared Quartz-oligoclase Gneiss. A thick, sill-like mass of intrusive granitic gneiss (10c) extends through the northern claims of the Ace group and is confined to the impure quartzite (7b) of the Wasekwan series. Contacts with the quartzite are sharp, but to the northeast, on Faust 115 claim, the gneiss becomes increasingly difficult to separate as a result of the number of quartzite bands in it.

The gneiss is a sheared, greenish grey weathering rock composed chiefly of oligoclase approaching andesine in composition. Feldspar constitutes 40 to 45 per cent of the rock, quartz 30 to 35 per cent, recrystallized hornblende 15 per cent, and biotite is present as a minor constituent. The texture displays crushing, both the quartz and feldspars having undergone considerable granulation. Locally the gneiss is porphyritic, and characterized by crushed quartz phenocrysts.

## Sickle Series

The Sickle series is represented in the area mapped by two isolated exposures lying to the southwest of the Heath claims. Consequently, in order to determine the relationship of these rocks to the Wasekwan series, an examination was made of the section across Lasthope Lake to the south where the Sickle series is exposed in a syncline. Here the series consists of feldspathic sandstone, grading into quartzite on the one hand and arkose on the other. The relief on these rocks is more irregular and rugged than on the formations of the Wasekwan series, and the Sickle rocks are well exposed on prominent, bald hills. The ridges, however, do not follow the trend of either the schistosity or the bedding, as in the Wasekwan series, except in the case of the conglomerate at the base of the Sickle, which forms a ridge. The feldspathic sandstone and quartzite present a massive appearance in smoothly glaciated outcrops that are commonly marked with concentric gouges. The rocks weather pink to light buff and, above the basal conglomerate, contain a few pebbles of pink "quartz-eye" granite, chert, and a number of other rock types. The bedding is almost imperceptible and has been masked largely by the development of schistosity. Where traces of the bedding were recognized they were observed to sweep in broad curves at various angles to the more constant trend of the schistosity.

The clastic nature of the Sickle series is well displayed on weathered surfaces, where it resembles a sandstone. In a few places grains of quartz and pink and grey feldspars up to one-quarter inch in diameter may be observed. On fresh surfaces, however, the rock is a grey schist, containing sufficient fine sericite to produce a silky lustre. A typical specimen contains 35 per cent or more quartz, 25 per cent potash feldspar and sodic plagioclase, and 25 per cent sericite, with minute amounts of green biotite, tourmaline, zircon, and apatite. The texture is cataclastic, both the quartz and feldspars having been crushed and granulated. The Sickle series near Lasthope Lake and to the north has been derived chiefly from the erosion of granitic rocks.

## Wasekwan-Sickle Unconformity

The unconformity between the Wasekwan and Sickle series is not exposed in the area mapped, and can only be inferred from former work done elsewhere in the district. Norman[1] has described the Sickle

---

1 Geol. Surv., Canada, Sum. Rept. 1933, pt. C, pp. 30-32 (1934).

---

series as

"a lithologically distinct series of bedded, quartzo-feldspathic sediments...This upper series is... one continuous succession of rocks without any conspicuous or important intervening break in deposition. A massive conglomerate that contains pebbles of pre-Sickle rocks occurs at the base of the series, and forms an important, easily recognized horizon; but the upper limits of this series are removed by erosion and cannot be defined. This bedded series of quartzo-feldspathic rocks is lithologically similar to the Missi series of sediments that are developed 150 miles or so to the southwest between Amisk and Kississing Lakes, and is probably of approximately the same age.

"Henderson in 1932 considered that the Sickle series consisted of a lower group of sediments and an upper group of acid volcanics with interbedded sediments. The writer has not visited many of the areas that were examined by Henderson in 1932 and at present cannot confirm the presence of volcanic rocks in this series.

"An unconformable contact of the Sickle conglomerate with older rocks was observed only on the east side of the long, narrow lake....which lies a short distance east of the south end of Sickle Lake. At this point the conglomerate strikes north and south and is overturned to the west. The pre-Sickle rocks...strike 80 degrees and dip steeply north. The schists are highly contorted and are sharply truncated by the overlying conglomerate (See Figure 1A). These relations indicate a definite structural unconformity between the Sickle and the older rocks and a period of erosion prior to the deposition of the Sickle series.

"The larger structural relations of the Sickle and pre-Sickle groups of rocks confirm the presence of a structural break between them. North of Chicken Lake the Sickle rocks are folded into a tightly compressed synclinal structure which has, for the most part, a north-south strike. Although the exact structure of the pre-Sickle rocks is not known, their general strike is more or less in an east-west direction. This east-west strike may be considerably diverted by intrusive granite, but it is in the main nearly at right angles to the strike of the Sickle rocks."

The two exposures of Sickle feldspathic quartzite in the area mapped are pebble-bearing to the extent that they contain about one pebble to each 10 square yards. The corresponding rocks on the south limb of the syncline at Lasthope Lake occur above the conglomerate and about 1,000 feet above the base of the Sickle series. From this it might be inferred that the base of the conglomerate on the north limb of the syncline is present in the drift-covered part of the area about 1,000 feet to the north of the Sickle exposures. Norman, however, states that the conglomerate is a tough, massive rock that tends to stand out as resistant ridges. In the area mapped the ground is, however, low in the belt beneath which the conglomerate would be expected to be present.

In the south arm of the area the Sickle series apparently lies on rocks of Division C of the Wasekwan series. Thus Divisions D to H, representing some 12,000 feet of the Wasekwan series, are not present. It is not possible to determine how much of this 12,000 feet may have been removed by erosion or by faulting. At Lasthope Lake the Sickle rocks are much more intricately folded on a minor scale than the older Wasekwan formations, and this suggests there may have been some faulting at the base of the Sickle series during its folding. However, an angular unconformity has been described southeast of Sickle Lake by Norman[1], and there is little

---

1 Geol. Surv., Canada, Sum. Rept. 1933, pt. C, p. 32 (1934).

---

doubt that the Wasekwan series was folded and eroded prior to the deposition of the Sickle rocks. This unconformity may represent an important break in the Precambrian record, and the possibility of a Proterozoic age for the Sickle series cannot be excluded.

## Post-Sickle Intrusive Rocks

Beyond the area mapped the Sickle series is subjected to widespread intrusion by granitic rocks. Within the area the Wasekwan series is enclosed by similar rocks (12 to 15), a large part of which is relatively little altered, is less deformed than intrusions classed as pre-Sickle, and is thought to have been intruded after or, in part, accompanying the deformation of the Sickle series.

Hornblende-Biotite-Oligoclase Gneiss. On the southern border of the mapped area a large mass of dark, dioritic rock is indicated as a post-Sickle dyke (See Map 344A, Granville Lake sheet). The body (12) forms a ridge with a steep, almost scarp-like northern slope that rises 200 feet above the creek valley to the north. The rock is dark grey to buff weathering and appears massive in outcrop. On fresh surfaces, however, it is gneissic and almost schistose. The rock is a medium-grained, recrystallized gneiss composed chiefly of oligoclase with subordinate biotite and hornblende and a small amount of quartz and titanite. It is probably an altered diorite.

Gneissic Granitic Intrusions. In the southern half of the area the Wasekwan series is bounded by intrusive granitic gneisses (13). One such body separates the north and south arms east of Wasekwan Lake. Another body borders the Wasekwan formations on the south and southwest of the north arm of the map-area. These rocks weather light to medium grey and resemble medium- to coarse-grained granite-gneiss. The gneissosity is a secondary structure, in part the product of shearing. Microscopic studies show that oligoclase or andesine is the dominant constituent mineral, and that little or no potash feldspar is present. In places quartz constitutes up to 35 per cent of the rock and in other places makes up less than 10 per cent. These rocks, therefore, despite their resemblance to granite, belong to the diorite family, and because they commonly contain as little as 10 or 15 per cent dark minerals, such as biotite, hornblende, or both, most of them could be included under the term oligoclase quartz diorite gneiss, or oligoclase diorite gneiss.

North of Division A of the Wasekwan series, on the south arm of the area, the basic breccia is bounded by grey granitic gneiss that cuts it at a slight angle. North from the contact the gneiss becomes more massive, and dark, elongated, partly digested inclusions are common. Near the contact the rock is a crushed, epidotized, biotite-quartz-andesine gneiss. On the base line the gneiss is a darker, more massive, altered diorite-gneiss composed principally of hornblende and andesine with minor quartz and epidote. In this locality it is cut by numerous trap dykes up to 14 inches wide.

Divisions A and B of the Wasekwan series are separated by a narrow belt of light grey diorite-gneiss that contains numerous small, dark, elongate inclusions. These are cigar-shaped and from 2 to 8 inches long. They appear to have originated in the adjacent greenstones and are rich in hornblende and biotite, but they have been observed in all stages of digestion in the gneiss. The latter is composed principally of andesine with quartz and a small amount of biotite, and the composition of the rock has no doubt been affected by contamination from the inclusions. Small dykes of trap and felsite cut the gneiss.

Southwest of the Wasekwan series, on the south arm of the area, the gneiss is light grey and contains numerous, small, elongate inclusions that pitch to the northwest. The rock is composed chiefly of oligoclase with subordinate quartz and small amounts of biotite and hornblende. East and west of Wasekwan Lake the dominant constituent mineral of the gneiss is oligoclase or andesine with subordinate quartz, hornblende, and biotite. The ferromagnesian minerals are commonly epidotized, and all minerals show some evidence of crushing.

Massive Granitic Intrusions. A body of massive granitic rock (14) underlies the northeast corner of the Faust claims and extends to the north and east. Much of this area is drift covered, and outcrops are small and not very numerous. Where observed, the intrusive rock is medium to coarse grained and grey to salmon-pink. The principal constituent mineral is plagioclase feldspar that ranges from oligoclase to andesine, and constitutes from 40 to 70 per cent of the rock; quartz is present in amounts up to 40 per cent; hornblende, up to 30 per cent; and biotite, up to 15 per cent. The rock ranges in different localities from a biotite-oligoclase-quartz diorite to a normal hornblende diorite.

A lenticular mass of granodiorite (14) intrudes the greenstones of Division E of the Wasekwan series on the Dave claims. This body is 9,600 feet long and has a maximum width of 2,700 feet. The rock is massive (locally crushed), grey, and consists of about 50 per cent sodic oligoclase, 20 per cent microcline, 20 per cent quartz, and a small amount of biotite and sericite. South of its western nose there is a small intrusive mass of rock composed chiefly of hornblende and labradorite.

On the Faust claims west of McVeigh Lake a body of white, granitic rock, 9,600 feet long and with a maximum width of 3,900 feet, is joined to a small body of syenite at the south end of McVeigh Lake by a narrow neck of dioritic material. The main body (trondhjemite) is medium-grained and composed of more than 70 per cent calcic oligoclase, 10 per cent biotite, and a minute amount of microcline. In the central part of the intrusion quartz forms up to 25 per cent of the rock, but within 200 or 300 feet of the border quartz is absent, and amphiboles appear as a minor constituent.

Syenite. A small body of syenite that contains gold-bearing quartz veins underlies the south end of McVeigh Lake. The syenite is pink weathering, coarse grained, and massive. Eighty-five per cent of the rock consists of microcline and albite in a ratio of 1.5 to 1. Biotite is the only other important constituent mineral. Near the borders of the syenite body albite replaces microcline as the dominant feldspar, the biotite content increases, and quartz appears.

The syenite body is joined with the main intrusive mass already described by a narrow neck of rock that appears to constitute a transition zone between the two. On the south side of the Austin vein, in the northwest corner of Faust 1 claim, the intrusion is a syenodiorite, but towards the southeast the content of potash feldspar increases until it becomes the dominant feldspar. On the north side of the vein microcline (and microperthite) make up less than 10 per cent of the neck, and the rock is a diorite consisting of 60 per cent plagioclase feldspar zoned from calcic oligoclase to sodic labradorite, 30 per cent hornblende, and small amounts of quartz and biotite. To the northwest this rock grades into the oligoclase-quartz diorite (trondhjemite) that constitutes the main part of the intrusion.

Dyke Rocks. The Wasekwan formations (1 to 8) and the altered granitic intrusive rocks (9, 10) are cut by numerous dykes (15), most of which are too small to be shown on the map. No pegmatite dykes were observed in the area mapped, and most of the dyke rocks are fine-grained and porphyritic.

One of the dykes mapped is an oligoclase porphyry (15a). It outcrops on the Ace discovery claim between Ace 14 claim and Ace 36 fraction. This dyke is about 20 feet wide, and has been intruded along a gentle drag-fold in the schists of Division F of the Wasekwan series. The rock is composed, approximately, of 20 per cent phenocrysts of sodic oligoclase set in a pepper and salt groundmass of quartz and feldspars with a little biotite and sericite.

In the northwest corner of G.D. 7 claim gold was discovered in a fractured albitite dyke (15b) 10 to 55 feet wide that pinches out to the northwest. The rock is composed almost entirely of albite with a little interstitial biotite, white mica, and apatite. It is pale pink to white weathering and quite fine-grained. Locally, hydrothermal alteration has resulted in the replacement of much of the albite by carbonate.

Fresh rhyolite dykes are not common in the area, but have been observed on the west boundary of Faust 1 and the north boundary of Faust 10 claims. The dykes are from 2 to 3 feet wide and the rock consists of clear, sparingly distributed phenocrysts of quartz and feldspar in a resinous dense matrix that resembles devitrified glass. Altered rhyolite dykes (15c), such as the one mapped on the 23rd base line on the Oro claims, are more common. They consist of crushed phenocrysts of quartz and albite in a very fine-grained, light, pepper and salt groundmass. Similar, but non-porphyritic dyke rocks are classified as felsite.

A dyke mapped on the Smoke claims and intersecting the 23rd base line consists of pink, coarse-grained, crushed gneiss composed of microcline and albite in a ratio 2 to 1. The feldspars occur as phenocrysts. Interstitial quartz, and minor biotite, epidote, and sericite complete the mineral composition of the rock, which is a porphyritic granite-gneiss (15d).

South of the 23rd base line the rocks of Division C of the Wasekwan series are intruded by a variety of very fine-grained, pink and white gneisses composed chiefly of microcline, albite, and quartz. Some of these rocks resemble the pink and white quartzites and can only be distinguished from them with difficulty. West of the claims on the 23rd base line the granitic gneisses are cut by swarms of trap dykes that commonly occur in groups of parallel intrusions. The dykes have been faulted, and horizontal displacements have been observed up to a maximum of 6 feet. The trap dykes are about 3 feet wide and, in a few places, cut across felsite dykes. In other localities trap and felsite dykes occur side by side in the same fracture. In the vicinity of the trap dykes are a few coarse-grained amphibolite dykes that may be altered lamprophyres. Small quartz veins occur in the gneiss and intersect all the dyke rocks.

## Pleistocene

Following the formation of the Sickle series there is no record of deposition in the area until Pleistocene time, when a thin mantle of glacial deposits was laid over the bedrock. Any stratified rocks that may have been laid down in the interval have been removed subsequently. The principal effect of glaciation was the modification of bedrock relief, but a large part of the present rock surface is the product of the erosive action of pre-glacial streams rather than direct glacial scouring.

During Pleistocene time an ice-sheet moved from north to south over the area, as indicated by striae and grooves on the rock surfaces that strike between south 5 degrees east and south 10 degrees west. Glacial gouges are commonly developed on the Sickle series and are concentric towards the south; on the Wasekwan rocks glacial markings are comparatively rare.

About half of the area is covered with muskeg, and the remainder consists of low ridges. Rock exposures are confined almost entirely to the higher ground. Rock ridges, except on the Sickle series, trend with the strike of the formations, namely east-west on the north arm of the area, and southeasterly on the south arm. The drift ridges, on the other hand, extend south as tapering tongues into the muskegs. Both drift and rock ridges are asymmetrical in cross-section, being steep on the north slopes and sloping gently into the muskegs to the south. Rock exposures occur low down on the north flanks of the ridges, on the crests, and high up on the south flanks.

The drift deposits that cover bedrock and underlie the muskegs consist almost entirely of sand and gravel. This material is, in places, bedded and crossbedded and, on the whole, is typical of the outwash deposits that form from the action of melt water derived from a wasting ice-sheet. Large muskegs to the west and southeast of Wasekwan Lake are flat, and are probably underlain by lake deposits, although no glacial lake varved clays have been observed anywhere in the area.

An unusual topographic feature is the presence of circular depressions commonly less than 150 feet in diameter. These are filled with angular to subangular blocks of rock, many of which weigh several tons. Apparently these blocks have not been moved far, for wherever the nature of the underlying bedrock could be determined it was found to be similar. Many of the gold-bearing quartz veins in the area were discovered by digging at places where quartz float had been found. The float was probably worked up to the surface by frost action.

The relief that is etched in the Wasekwan rocks shows an excellent adjustment of topography to structure. Thus, on the north arm of the area, where the trend of both the formations and ridges is to the east, the effect of glaciation has been only to modify the pre-existing topography. This adjustment is sufficiently well developed to require an extensive period of subaerial erosion and, therefore, implies a pre-glacial origin. This concept of the superficial effect of glaciation has further support in the presence of rock, observed in test pits, that has been weathered to clay, although the schistosity is still preserved in it. Such thorough weathering as this indicates a pre-glacial or at least inter-glacial origin, and suggests that the depth of glacial erosion was not great.

## STRUCTURAL GEOLOGY

In the McVeigh Lake area, as in most areas of Precambrian rocks, the interpretation of the stratigraphy is dependent largely on a knowledge of the geological structure of the formations. The Wasekwan and Sickle series are both closely folded and, as the folding is isoclinal, the fold axes cannot be determined merely by plotting dips. It was necessary, therefore, to search for such features as graded bedding and crossbedding in the sedimentary rocks, and the accommodation of pillows in the lavas, in order that the directions faced by the tops of the beds might be determined.

Graded bedding and crossbedding are well developed in the feldspathic quartzites of the Sickle series, and a study of these inherent features leaves no doubt that this series is exposed in an easterly trending syncline at Lasthope Lake. In the Wasekwan series, however, there are no such features by which the directions faced by the tops of the beds and flows can be determined. In the pillow lavas of Divisions E and H, for instance, the pillows are so deformed that no reliable determinations of the tops of the flows could be made. Mapping of the Wasekwan was, consequently, carried on with the purpose of tracing the formations as far as they could be followed in any direction. This resulted in the determination of a large fold in which the pitch of the structure on the north arm of the area was found to be to the west, and on the south arm to the northwest. Determinations of pitch were made by recording the angle of plunge of deformed features such as breccia fragments and stretched pillows, and by the plunge of the long dimension of prismatic metamorphic minerals, such as hornblende. The pitch of small drag-folds was also found to be in agreement with the information recorded in this manner.

As a result of this work it was determined that the westerly pitching fold exposing the Wasekwan series was anticlinal.

This interpretation results in facing the tops of the beds on the south arm towards the Sickle series, as was to be expected. South of the 23rd base line the beds dip steeply south, but north of the line the same formations are overturned towards the north. The fact that the same bed changes direction of dip along the strike suggests a torsional movement. This movement is believed to be responsible for the formation of the set of secondary fractures in the grey quartzite (3f) of Division C. These fractures are filled with quartz, but are earlier than the gold-bearing fractures.

On the north arm of the area the south limb of the anticline is overturned to the north, and the dips of the beds are somewhat steeper than the dips of the corresponding beds on the north limb, which are as low as 50 degrees. Elsewhere on the north arm dips are to the north, except in the northwest corner of the area mapped where the strata become vertical or dip steeply south. Near the southeast shore of Fraser Lake and on the northwest claim of the Faust group two sedimentary beds in the basic lavas are repeated by folding in such a way as to suggest that a synclinal axis passes through this section. If this assumed fold axis is projected southwest on its strike for $4\frac{1}{2}$ miles it would correspond to a syncline of Sickle rocks folded in the pre-Sickle that is shown on the west half of the Granville Lake sheet, Map 343A. So far as is known, the rocks in this syncline represent the youngest pre-Sickle rocks and, therefore, the top of the Wasekwan series.

On the south arm of the area the Sickle series is in contact with the rocks of Division C of the Wasekwan series, indicating that about 12,000 feet of the Wasekwan rocks above this subdivision have been eroded. Norman[1] has described a right-angle unconformity with

1 Op. cit., p. 32.

pre-Sickle schists butting up against the Sickle basal conglomerate. Thus it would appear that the Wasekwan series was folded and eroded prior to the deposition of the Sickle rocks. As the Sickle series is also folded the Wasekwan rocks have been involved in two periods of folding. Yet the Sickle feldspathic sandstones are more intricately folded on a minor scale than the Wasekwan formations. On the south arm of the area the different formations of Division C can be traced for 4 miles without evidence of minor folding, whereas the bedding in the Sickle rocks exhibits complex contortions. This suggests that the Sickle series acted incompetently during folding, and that the previously folded Wasekwan beds formed a more or less rigid base. If so, the unconformity between the two series is probably marked by faulting in many places (Figure 1B). This explanation would, in part, account for the relatively more intricate folding of the Sickle series.

Relation of Schistosity to Bedding. Schistosity in the rocks of the Sickle series does not conform, necessarily, in direction to the schistosity in the Wasekwan formations. In the Sickle series schistosity is developed independently of bedding and is uniform in strike, whereas the bedding planes are contorted so that they trend in various directions. In the Wasekwan series schistosity conforms to the bedding, even around the noses of plunging folds. This may be explained by differences in the lithological character of the two series. The feldspathic quartzites of the Sickle series are more or less homogeneous and, as a result, bedding in them is poorly developed.

Thus under conditions of deformation the feldspathic quartzites have yielded along their weakest direction, which in a homogeneous rock corresponds to the planes of maximum shearing stress, and the resulting schistosity is developed irrespective of bedding. The Wasekwan series, on the other hand, consists of alternate formations that have different degrees of resistance to stresses. The initial deformation of rocks of variable competency, such as these, would result in a certain amount of slipping between the beds, the schistosity produced in this manner accentuating the original heterogeneous character of the series. As explained by F.J. Turner[1],

---

1 Current Views of the Origin and Tectonic Significance of Schistosity; Trans. Roy. Soc. New Zealand, vol. 72, pt. 2, 1942, p. 123.

---

"Under these circumstances slip will tend to occur along the mechanically weak --- surfaces already present, rather than on planes of higher shearing-stress for which the strength of the rock is also greater.".

According to the writer's experience elsewhere in the Canadian Shield, as in the McVeigh Lake area, the coincidence of bedding and schistosity is most common in rocks of relatively high metamorphic grade, that is, in the so-called garnet zone of crystalline schists and gneisses, although garnet itself may not be present.

Minor Structures. Minor folds are not common in the Wasekwan series except in a few localities. On the C.L. claims all formations are drag-folded, resulting in an apparent thickening of the rocks of Division D. The anticlinal axis west of Foster Lake is complicated by a minor synclinal fold that has resulted in a repetition of some of the strata. Owing to lack of criteria for determination of tops of beds, small folds could exist unrecognized within the different subdivisions.

No faults of large displacement were recognized in the area, although one or more strike faults may be expressed as shear zones. A few minor faults were mapped on the Oro claims south of the 23rd base line and on the Dave claims, and no doubt there are many others. Some of the minor faults are relatively late in the history of these Precambrian rocks as they displace small trap dykes that intrude the post-Sickle granitic gneisses.

## GEOLOGICAL HISTORY

A brief account of the probable sequence of geological events in the area begins with the formation of the Wasekwan series. These rocks were laid down during a period in which volcanic activity alternated with sedimentation. Later the formations were folded and it is likely that they were partly altered to schists as a result of the deforming stresses. Granitic intrusion accompanied or followed this initial deformation, and is represented by the large folded granite sill in the Wasekwan series and by the abundant granite pebbles in the basal conglomerate of the Sickle series.

There followed a period of prolonged erosion that was of sufficient duration for the removal of as much as 12,000 feet of rock from the south arm of the Wasekwan anticline. Later the Sickle basal conglomerate was laid down on the truncated surface of the Wasekwan series, and this was followed by the deposition of a considerable thickness of feldspathic sandstone. The lithology of the Sickle series indicates that it was derived largely from the erosion of granitic rocks. A second period of folding took place, which involved both the Sickle and the underlying Wasekwan series. The extent to which the older rocks were affected by the second folding is not determined. The previous discussion of the development of schistosity in the rocks has shown that the two series responded independently to deformation. This is further suggested by the fact that the pebbles of the Sickle conglomerate have been squeezed to disk shapes, whereas analogous fragments in the Wasekwan volcanic breccias have been deformed into cigar-like shapes. The attempt to reconcile these differences has led to the suggestion that the already folded and eroded Wasekwan series acted as a more or less rigid base on which the Sickle series was folded.

Widespread granitic intrusion followed the folding of the Sickle rocks, as indicated by the presence of folded inclusions in the granite and by associated dykes that cut deformed structures in both the Wasekwan and Sickle series. This granitic intrusion is believed to be the agency of metamorphism that resulted in the development of a common mineral suite in the various members of the Wasekwan series and raised their rank to that of more highly metamorphosed schists. The intensity of metamorphism gradually increases as the granitic bodies are approached.

The granitic rocks are cut by trap dykes, the latter being displaced by small faults, indicating that post-granite stresses were operative. Similar zones of late movement are present at various places in the Wasekwan series, and the gold-bearing quartz veins are found in restricted zones of shearing formed at this time. Along such zones the metamorphic minerals are minutely brecciated and have partly degenerated to chlorite and albite. In those zones that contain gold-bearing quartz veins further retrograde mineral alteration has taken place as a result of accompanying hydrothermal activity, chief of which was the formation of carbonate. Early quartz is locally brecciated and was followed by the deposition of carbonate, later quartz, sulphides, and gold. Not only is gold the latest mineral present, but, more significantly, the gold-bearing fractures were formed late in the sequence of geological events.

## GOLD OCCURRENCES

Gold is the only mineral yet found in the map-area and surrounding district that is likely to be of commercial importance. Prospecting for gold in northern Manitoba had extended into the region north of Granville Lake by 1930, and in the following years a number of discoveries were made. The initial examination of prospects did not disclose any commercial orebodies, and interest in the area lapsed. The first gold discovery in the map-area was made north of Lasthope Lake in 1937. This was followed by intensive prospecting in the district by field representatives of Central Manitoba Mines, Limited, and Sherritt Gordon Mines, Limited, and resulted in the discovery of several gold occurrences in the vicinity of McVeigh and Wasekwan Lakes. A large number of claims was staked on behalf of these companies. The Sherritt Gordon Company, through options, gained control of the Smoke, Nencie, Heath, and C.L. groups of claims, and by 1941 owned or controlled all the claims in the area.

The staked ground consists of two blocks of surveyed claims. The larger group of more than 350 claims covers the north arm of the area for a distance of about 11 miles in an east-west direction. The smaller group of 67 claims lies southeast of Wasekwan Lake and north of Lasthope Lake. Sherritt Gordon Mines conducted an intensive program of prospecting on the properties, and a number of additional gold discoveries were made. Development operations up to 1941 consisted of trenching and diamond drilling of a few localities, but at the time of the writer's visit (1940) some of the discoveries had not been explored systematically.

Diamond drilling of the original discovery on the Smoke claims is reported by Sherritt Gordon Mines, Limited, to have disclosed 140,000 tons of vein material carrying 0.23 ounce in gold a ton. South of McVeigh Lake mineralization has been found in one or more shear zones over a total length of 4,500 feet. Development work on this zone has indicated the presence of narrow, short ore shoots that carry about 0.27 ounce in gold a ton.

General Character of the Gold Occurrences. Gold has not been reported in the Sickle series, and all finds made to date are in the Wasekwan series. This is to be expected, because the heterogeneous character of the latter series offers more favourable conditions for fracturing, and hence for the formation of gold-bearing quartz veins. Mapping has shown that most of the gold discoveries are limited to two particular stratigraphic horizons. On the south arm of the area mapped the gold-bearing veins are confined to the grey, feldspathic quartzite (3f) of Division C. On the north arm most of the gold occurrences are in a shear zone in Division D near its contact with the overlying Division E. Gold-bearing quartz veins also occur in fractures in late intrusive rocks.

Gold occurs in quartz fissure veins or with quartz stringers that fill fracture systems or shear zones. The gold is associated with sulphides, particularly galena and sphalerite, that are sparingly and irregularly distributed in the quartz and, to a lesser extent, in the wall-rocks. The quartz has been introduced as an open-space filling and there is little, if any, silicification of the country rocks. Wall-rock alteration is limited to minor carbonatization.

Formation of Fractures. Most of the gold occurrences are associated with dykes and small bodies of undeformed post-Sickle intrusive rocks. This relationship appears to be structural; and the genesis of the deposits remains a matter of speculation. The fractures in which the gold-bearing veins occur were formed late in the Precambrian record of the district, and in many places intersect the youngest granitic rocks. There are many fracture systems and shear zones in the Wasekwan formations that are related to one or other of the two periods of folding to which these rocks have been subjected, but gold has not been found in quartz veins filling fractures of this nature. Evidence of late movement was observed in the faulting of post-granite trap dykes, and it may be to movements at this time that the gold-bearing fractures owe their origin.

On the Smoke claims the gold-bearing veins are confined to a particular hornblende-biotite-bearing feldspathic quartzite (3f). This formation is bounded on the northeast by massive, tough, hornblende gneiss that forms a ridge. Both formations have been subjected to torsional stresses and, as a result, a fracture has formed in the impure quartzite at an angle of 35 degrees to the bedding.

These secondary fractures are filled with quartz that is earlier than the gold-bearing quartz. The principal gold-bearing vein on Smoke 2 claim is parallel to the strike of the bedding and intersects the earlier quartz. Near the vein and parallel to it is a fresh appearing, undeformed, porphyry dyke, and a similar smaller dyke is intersected by the vein quartz. The parallelism of the vein and dyke suggests that the latter acted as a competent body under stress, controlling the formation of parallel fracturing in the adjacent, less competent quartzite. This particular quartzite is a brittle rock that has been fractured repeatedly and offers the best prospecting possibilities in the south arm of the area.

On the Ace claims gold has been found in a small quartz vein adjacent to a narrow feldspar porphyry dyke that was intruded along a gentle drag-fold. Some of the gold occurrences, however, are within the intrusive rocks themselves. On the C.L. claims gold occurs in quartz stringers in a fractured albitite dyke. A number of gold-bearing quartz veins has been uncovered in the small syenite body at the south end of McVeigh Lake. The veins occupy a northeast-trending fracture system in the intrusive rock. All these intrusions, except for the late trap dykes, are the youngest rocks in the area, and in all cases the fractures in which the veins occur were formed after the consolidation of the intrusive rocks.

Gold has been found in a number of places in zones of shearing in the rocks of Division D of the Wasekwan series between Reservoir and Franklin Lakes. Here again is an instance of gold associated with late formed fractures. The rocks comprising Division D are bounded on the south by a massive folded sill of granite-gneiss. Under stress this body probably acted as a buttress, and the adjacent formations then yielded by shearing.

The gold-bearing fractures have formed as a result of post-folding and post-intrusive stresses, and have been localized adjacent to or within small intrusive bodies.

Mineralization. Some of the quartz veins are up to 4 feet or more in width, but are generally much narrower. In some of the occurrences narrow veins and quartz stringers occupy mineralized zones that are up to 30 feet wide. Galena, pyrite, chalcopyrite, and sphalerite occur in the quartz, but pyrite and chalcopyrite also occur in the country rock where it is sheared or fractured. Sulphides constitute up to 10 per cent (generally much less) of the vein material, but these minerals, as well as the gold, are irregularly distributed. As a result, diamond-drill cores are not likely to contain representative samples of the veins. In replacement deposits, where the gold tends to be more evenly distributed, assays of diamond-drill cores often correspond closely to bulk sampling, but in gold deposits of this type the results of systematic drilling cannot be regarded as conclusive.

The vein quartz is fractured and in some cases exhibits minute brecciation, but the associated sulphides are unaltered, and are presumed to have been introduced after the fracturing of the quartz. In the shear zone south of McVeigh Lake, known as the Johnson shear, the best mineralized sections are associated with a narrow zone, only inches wide, of a pale green, waxy, low specific gravity rock. This rock has an extremely fine, crushed texture in which quartz with minor chlorite and biotite occur in an interstitial carbonatized paste of the same material. The rock is interpreted as a carbonatized fault gouge. The adjacent vein quartz is minutely brecciated, and the comminuted quartz is, in part, replaced by carbonate.

Carbonatization appears to have followed the formation and fracturing of the quartz veins, and is associated with the sulphide minerals. No silicification of the country rock was observed, and the development of carbonate implies loss of silica.

An occurrence of gold on the northeast shore of Franklin Lake may throw some light on the mineral sequence. At this locality gold was found in a shear zone that may be a continuation of the Johnson shear. The zone contains a number of mineralized quartz stringers, and these are cut at a sharp angle by quartz-chlorite veins less than an inch wide. The quartz-chlorite veins were formed in two stages. In the first, euhedral quartz crystals formed along the walls of narrow, open fractures. In the second, the remaining open space was filled with quartz, chlorite, and gold. Some of the gold is interstitial to the earlier quartz, and has filled cavities around the crystal surfaces. A little galena is associated with the gold.

Small particles of visible gold were seen in a number of the occurrences, but are not common. Gold, where it has been observed, is associated with galena, but it occurs in the adjacent gangue minerals rather than in the sulphide itself. The presence of galena in quartz has been used successfully by the prospectors in the district in locating gold occurrences, and a number of discoveries have been made by digging in the vicinity of mineralized quartz float.

Selected specimens of mineralized vein material collected by the writer were assayed by the Bureau of Mines for gold, silver, and lead, with the following returns:

| Locality | Gold (Au) | Silver (Ag) | Lead (Pb) |
|---|---|---|---|
| | ozs./ton | ozs./ton | |
| C.L. Discovery | 0.13 | 5.65 | 2.49 |
| Austin vein | 1.63 | 9.94 | 7.09 |
| Ace vein | 2.44 | 9.03 | 4.80 |

The specimens are not representative of the general tenor of the veins, but were chosen because of their high galena content to determine the extent to which this mineral carries silver.

## DESCRIPTIONS OF PROPERTIES

### Lasthope Lake Gold Mines, Limited

Lasthope Lake Gold Mines, Limited, was formed in 1940 by Sherritt Gordon Mines to take over the 67 surveyed claims on the south arm of the area. The property comprises the Smoke, Heath, Nencie, Oro, and D.N. claims. The original gold discovery was made in 1937 by Dick Madole, who staked the Smoke, Nencie, and Heath claims. In the autumn of 1938 the vein was sampled by J.P. Gordon, who obtained control of the claims and optioned them to Sherritt Gordon Mines early in the summer of 1939. In the meantime, Fred Johnson, prospecting for the Sherritt Gordon Company, had found gold in quartz veins to the northeast and staked the Oro group. In September 1940 the present company was incorporated to include all these claims.

The initial development work on the vein, which is near the southwest boundary of Smoke 2 claim, consisted of blasting shallow test pits. In 1939 the Sherritt Gordon Company probed the vein with 59 diamond-drill holes totalling 10,260 feet. The holes were drilled in three banks designed to intersect the vein at different elevations down to 150 feet. The company reported that this drilling had disclosed approximately 140,000 tons of material carrying about $8 in gold a ton. No work has been done on the property since the completion of the drilling.

The vein is exposed well up on the south flank of a low ridge and outcrops over a length of 735 feet (Figure 2A), striking north 45 degrees west and dipping southwest at 80 degrees. The quartz is from 2 to 4 feet wide and fills a fracture in thinly bedded impure quartzite. The vein is bounded on the north by a felsite dyke, and on the south by chert-like feldspathic quartzite and hornblende schist, which is intruded by a quartz-feldspar porphyry dyke. The porphyry was not seen exposed, but was observed in diamond-drill cores. The vein consists of crushed, sugary quartz with a small amount of chlorite, and is sparingly mineralized with pyrite, chalcopyrite, and sphalerite, and a very small amount of galena. No visible gold was observed either in hand specimens or under the microscope in polished specimens. Forty feet to the north is a somewhat wider quartz vein that contains little or no gold.

## Sherritt Gordon Mines, Limited

Central Manitoba Option. The Central Manitoba option consists of the C.L. group of claims lying to the east of Wasekwan Lake. The claims were staked in August 1939 by F.D. Cheswright and Gordon Linklater on behalf of Central Manitoba Mines, Limited. In the previous month Mr. Linklater and William Morrison staked the Lux group between Wasekwan Lake and the Oro claims, but the claims were allowed subsequently to lapse. The C.L. group was optioned in July 1940 to the Sherritt Gordon Company, who surveyed them. Gold was discovered in the northwest corner of C.L. 7 claim and the original stakers opened up the discovery by means of five trenches. In August 1940 this zone was explored by Sherritt Gordon Mines with ten diamond-drill holes.

The gold occurs in a fractured albitite dyke cutting tuffaceous sediments (Figure 2B). The dyke strikes west-northwest and dips northeast at 55 to 60 degrees in conformity with the enclosing formations. It averages 20 feet in width, pinches out to the west, is thoroughly shattered, and the fractures are filled with a reticulating network of quartz stringers. The quartz carries galena and a little pyrite and sphalerite. Gold is reported to occur in the quartz in association with the sulphides.

The albitite is partly replaced by ferruginous carbonate that weathers a characteristic rusty colour. The hanging-wall rock is carbonatized and, locally, contains abundant secondary biotite and chlorite. The albitite is relatively unweathered, but included bands of schist are weathered in places to a depth of more than 6 feet. Rusty soil observed in the trenches is overlain by fresh glacial deposits.

It is reported that surface sampling of the mineralized quartz indicated commercial quantities of gold over an average width of 20 feet and for an exposed length of 430 feet, but because of deep weathering it was impossible to obtain fresh material for samples. The assays of diamond drill cores were reported to be disappointingly low in gold.

Faust Claims. In the summer of 1938 Austin McVeigh and Jim Sayies, prospecting for the Sherritt Gordon Company, found gold on the southwest shore of the lake now known as McVeigh Lake. Later Austin McVeigh found gold-bearing quartz float in the bed of the creek draining Foster Lake into Reservoir Lake. As a result, the staking of the Faust claims was begun by Austin McVeigh and Dave Foster in July 1939. During that summer the Sherritt Gordon Company maintained four prospecting parties in the district and, as a result of intensive search, gold was found on the south shore of Reservoir Lake by Fred Johnson. In the autumn of 1939 the Austin vein was found by Mr. McVeigh on the west shore of McVeigh Lake. The following summer, in 1940, the western extension of the Johnson shear was located by William Morrison, and gold was discovered farther west on the shore of Franklin Lake by Austin McVeigh.

## Johnson Shear Zone

The Johnson shear zone was first located by float on the creek draining Foster Lake into Reservoir Lake and, later, mineralization was found in place on the south shore of Reservoir Lake (Figure 2C). The ground on the westerly strike of this zone was prospected and explored at intervals by means of trenches. As a result of this work gold was found at a number of places south of the north boundaries of Faust 4, 3, and 11 claims over a total length of 4,500 feet. In 1940 parts of the zone were probed by forty-five diamond-drill holes, totalling approximately 7,000 feet. Closely spaced holes were drilled over a length of 230 feet on Foster Lake Creek, and over a length of 140 feet on the south shore of Reservoir Lake. On Faust 3 and 11 claims holes spaced about 100 feet apart have been drilled over a length 2,300 feet. Some short narrow shoots approaching ore grade have been disclosed as a result of surface sampling and diamond drilling. Further drilling was done in 1941.

The Johnson zone consists of one or more narrow zones of shearing in rocks of Division C of the Wasekwan series, about 150 to 300 feet south of the contact with rocks of Division D. The shearing strikes easterly and dips steeply north. Persistence of mineralization and shearing over such a considerable length argues for favourable conditions for gold deposition. The shear zone is in a complex group of hornblende schists of probable tuffaceous origin, and impure quartzites. The zone passes through one lithologic type to another, as the shearing was developed after folding and passes in and out of minor folds.

On the south shore of Reservoir Lake the zone has been stripped across a width of 20 feet, and contains four quartz veins between 4 and 8 inches wide. The veins are sparingly mineralized with galena, pyrite, and chalcopyrite. Gold is reported to be associated with the sulphides in quartz. The country rock exhibits considerable brecciation, and there is evidence of faulting at an acute angle to the general strike of the shearing. The rock in the shear zone has been carbonatized as a result of hydrothermal alteration. Part of this rock consists of light grey-green, waxy material that is thought to be carbonatized fault gouge. Although the adjacent quartz is crushed, the sulphides in it are unbrecciated. In the north-central part of Faust 2 claim the zone contains two quartz veins that are from 6 to 12 inches wide and associated with grey, waxy material. The quartz is mineralized with chalcopyrite and lesser amounts of galena, sphalerite, and pyrite. In some localities actinolite occurs adjacent to the quartz.

The Morrison extension south of the No. 1 post of Faust 11 claim consists of a 4- to 10-inch quartz vein in a shear zone 2 to 3 feet wide. The shearing occurs in thinly laminated, biotite-bearing quartzite containing thin beds of amphibole-rich material from 1/8 to 1/2 inch thick. The quartz contains galena with pyrite and a small amount of sphalerite. Farther west the shear zone is 8 feet wide and contains numerous quartz stringers sparsely mineralized with sulphides and associated with carbonatized, grey, waxy material.

## Franklin Lake Discovery

Gold was found on a low cliff at the northeast shore of Franklin Lake. The country rock consists of grey quartzite and feldspathic amphibole-rich quartzite. These rocks are sheared over a total width of 40 feet in a zone striking south 50 degrees west and dipping 80 degrees northwest. Significantly, this zone is at the same stratigraphic position with respect to the overlying Division E as the Johnson shear zone, and may be the continuation of it.

The shear zone contains quartz stringers sparingly mineralized with sulphides and associated with chlorite and carbonate. It is intersected by fractures that strike north 86 degrees west and that contain quartz-chlorite veinlets from 1/2 to 3/4 inch wide. The veinlets in some places carry coarse, native gold and minute amounts of galena and pyrite. Microscopic examination of this material shows it to contain euhedral quartz crystals cemented by small amounts of gold, but mostly by quartz and chlorite.

## Austin Vein

The Austin vein was located in drift-covered ground in the northwest corner of Faust 5 claim as a result of trenching in the vicinity of mineralized float. The vein has been opened by a few trenches over a total length of 400 feet. Assays are reported to have indicated commercial amounts of gold, and diamond drilling of the vein was begun in January 1941. The Austin vein strikes northeasterly across the narrow neck of diorite that joins the large body of oligoclase granite (trondhjemite) on the Faust claims to the smaller mass of syenite at the south end of McVeigh Lake (Figure 2C). It fills a fissure from 1 to 4 feet wide and dips steeply northwest. The quartz is shattered and mineralized with pyrite, galena, and a little sphalerite. The country rock ranges from diorite to monzonite, but where it is included in the vein the feldspars are completely albitized.

## Other Gold Occurrences

Additional gold discoveries have been made on the Faust claims in the syenite body at McVeigh Lake. These include the original gold discovery made at McVeigh Lake in 1938 (Figure 5). The veins occur in northeast-trending fractures in the syenite and dip at various angles. They are narrow, short, and not likely to be of economic importance. The quartz is mineralized with galena and, as in the case of most of the other occurrences, visible gold is rarely observed. Two of these veins were probed with exploratory diamond-drill holes late in 1940.

### Ace Vein

Gold-bearing float was found on the boundary between Ace 14 claim and Ace 36 fraction in 1939, and in the following summer prospecting in this locality disclosed a quartz vein. The overburden was stripped over a small area, and a few shallow test pits sunk in the quartz (Figure 2D). The enclosing rocks consist of interbedded quartzite and hornblende schist that are deformed into a gentle drag-fold into which an oligoclase porphyry dyke was intruded. A short distance south of the bend in the dyke there is a narrow, irregular quartz vein. The quartz is mineralized with galena and sphalerite and small amounts of pyrite and chalcopyrite. Visible gold was observed by the writer in quartz from one of the test pits. Coarse gold was reported in a short quartz vein occupying a fracture in the porphyry dyke. The vein was drilled subsequently and one economic intersection reported.

### Dave Claims

No gold occurrences were known on the Dave claims prior to the staking of this group, but during the summer of 1940 gold is reported to have been found in quartz south of Shortie Lake.

### Granville Lake Mines, Limited

Granville Lake Mines, Limited, is reported to have been formed in June 1934 to develop twelve claims on the shore of Cartwright Lake. The property is situated a few miles east of the area mapped. The property was not examined by the writer, but was investigated in 1935 by Alan M. Bateman. Professor Bateman has kindly loaned the writer his notes and the following comments are taken from them.

The property consists of eighteen unsurveyed claims staked by Messrs. Hanson and Akers. The showing had been sampled by Mr. F.L. Smith for Mr. R.J. Jowsey, and by representatives of Messrs. Alderson and MacKay, Ventures, Limited, and Hudson Bay Mining and Smelting Company. The latter company opened negotiations for an option, but no satisfactory agreement could be reached. Control is reported held by Mr. and Mrs. Peter Durie, who originally grubstaked the prospectors. The property lies on both sides of the south arm of Cartwright Lake, and the main showing, on the east side of the lake, has been stripped for about 125 feet east of the water's edge.

Gold occurs in a porphyry dyke that is from 30 to 50 feet wide and at least 260 feet long. A similar mineralized dyke outcrops on the opposite shore of the lake, 1,000 feet distant, and a further 1,500 feet to the westward--all on the same line of strike. The dyke is an altered, red porphyry that intrudes greenstone. The porphyry is fractured, contains a network of quartz stringers, and is lightly impregnated with sulphides. Owners channel sampling is reported to have yielded $11.90 across 30 feet. Sampling by Professor Bateman returned $10.60 across 20 feet. Owing to the possibility of a large tonnage of low-grade ore in the dyke an attempt was made to conclude an arrangement with the principals to carry out further work, but no agreement could be reached. The property has remained inactive since 1935.