ONTARIO DEPARTMENT OF MINES

Geological Report No. 41

High Lake - Rush Bay Area

By

J. C. DAVIES

1965

ONTARIO
DEPARTMENT OF MINES

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Geology of High Lake–Rush Bay Area

District of Kenora

By
J. C. DAVIES

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TABLE OF CONTENTS

PHOTOGRAPHS

FIGURES

TABLES

COLOURED GEOLOGICAL MAPS
(back pocket)

Abstract

The report summarizes the geological features of High Lake–Rush Bay area, of about 165 square miles, immediately north of Shoal Lake and adjacent to the Manitoba boundary. The information was obtained during two summers of detailed field-mapping, augmented by exploration results of mining companies.

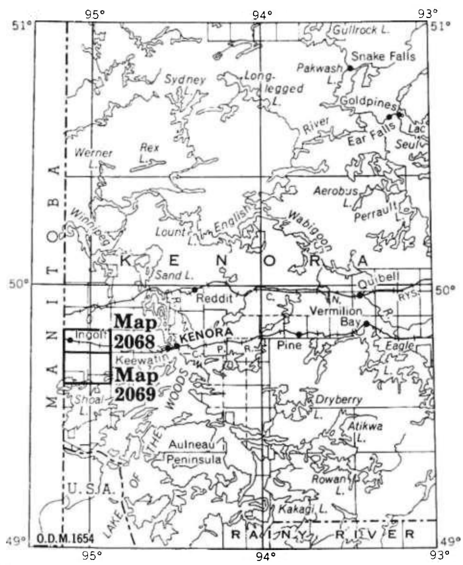

Figure 1 — Key-map showing the location of the map-area. Scale, 1 inch to 50 miles.

The area includes rocks of the Keewatin group, being part of the Keewatin type area mapped by A. C. Lawson in 1885. The rocks are basic, intermediate, and acid flows and pyroclastic rocks, and subordinate sedimentary rocks. Some coarse-grained basic rocks are intrusive into the above group. The Crowduck Lake group of steeply dipping sedimentary rocks, dominantly conglomerate and arkose, rests unconformably on granodiorite that has intruded the Keewatin volcanic rocks. Most of the acid intrusions are considered to be younger than the Crowduck Lake group, but some may be older.

Foliation in an east-west direction persists throughout the map-area. Folding occurs, but criteria for determining directions of tops are few and poorly developed. Slip folding appears to be of major importance, the vertical component of slip being greater than the east-west component.

A number of gold, copper, and molybdenum properties are located in and near the older granodiorite, north and east of High Lake. One copper deposit is of the porphyry type.

Geology of High Lake–Rush Bay Area

By

J. C. Davies[1]

Introduction

The map-area lies immediately north of Shoal Lake and adjacent to the Manitoba border. The proximity of the southern part of the area to Shoal Lake, and the existence of a number of minor canoe routes, have been important factors in the long history of prospecting in the area. Though the only extensive underground development work was at the Golden Horn mine in the first decade of this century, considerable surface exploration in the High Lake area since 1935 has produced some encouraging results.

The geological mapping, which provides the basis for this report, was begun during 1961 when exploration was at a peak; it was continued to the north the following summer in order that the north edge of the volcanic and sedimentary sequence might be delimited and some minor aeromagnetic anomalies investigated. Since the two northern townships proved to be largely underlain by granite, a strip 2 miles by 12 miles was mapped to the south, thus completing the mapping of irregularly shaped Ewart township.

All mapping was done by pace-and-compass methods, except along roads and lake shores. Traverses in Ewart township, and in that part of Gundy township where volcanic and sedimentary rocks occur, were spaced 1,000 feet apart. The whole of Forgie township was traversed at quarter-mile intervals, but in the granitic areas of Gundy and Broderick townships traverse lines were spaced 1,500 feet apart. The actual location of traverses in Gundy and Broderick townships is indicated on preliminary maps P.181 and P.182, but for the sake of clarity is not shown on the preliminary maps of Ewart and Forgie townships (maps P.144 and P.145, respectively). All outcrops investigated were plotted on acetate sheets taped to vertical air photographs; this information was subsequently transferred to basemaps where geological information was recorded. Duplicate geological data were traced on to cronaflex basemaps. All air photographs and basemaps are on a scale of 1 inch to 1,320 feet. The basemaps were prepared by the Cartography Unit of the Ontario Department of Mines from basemaps of the Forest Resources Inventory, Ontario Department of Lands and Forests.

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[1]Resident geologist, Ontario Dept. Mines, Kenora.

Acknowledgments

Able assistance during 1961 was provided by J. M. Hodgkinson, W. G. McLennan, and D. M. Keith; in 1962, by J. A. Gilliland, K. A. MacLean, G. T. Powell, and Alex Brown. Mr. Hodgkinson acted as senior assistant during 1961 and did half of the mapping in Ewart and Forgie townships. In 1962, Mr. Gilliland and Mr. MacLean carried out most of the mapping in Gundy and Broderick townships, and about 60 percent of the mapping in the southernmost strip of the map-area.

Air service, required during one month of the 1962 field season, was provided by the Ontario Department of Lands and Forests. This department also provided helpful information on forests, forest fires, fish, and game.

The author wishes to thank the Indians at Shoal Lake who, through their chiefs, permitted the mapping of their reserve. Mr. W. P. Mackle kindly provided the use of a cabin during parts of both 1961 and 1962. Thanks are also due to W. N. Taylor and C. A. Alcock, who guided the author to a number of mineral occurrences, and to Mr. Mackle and Mr. Alcock for providing drill logs and related maps not filed with the Department for assessment purposes.

Chemical analyses and assays were done by the staff of the Laboratory Branch, Ontario Department of Mines. Additional analyses of rocks from the area, part of a project undertaken at the University of Manitoba, were made available to the author and were useful in rock nomenclature.

Means of Access

Highway No. 17 crosses the northern parts of Forgie and Ewart townships, the Manitoba border being about 32 miles west of Kenora. Secondary roads lead from the highway to the Shoal Lake Indian Reserve, and to Rush Bay of Lake of the Woods. The Shoal Lake road is an all-weather road, and trails lead from it to High Lake and to Canoe Lake.[1] Several small roads provide access to tourist cabins near the highway. The main line of the Canadian Pacific Railway passes through the central parts of Gundy and Broderick townships. A local train, which runs once a week, will stop at any point along the line. Ingolf, on the Canadian Pacific railway near the Manitoba border, is also accessible by a secondary road, which leads from Manitoba highway No. 4.

The natural-gas pipeline service-road lies ½–1 mile south of the Trans-Canada Highway, except in eastern Forgie township where it is about ¼ mile south. This road provides useful access to parts of the map-area, but is impassable to normal vehicles at a number of places.

Canoe routes exist in most parts of the area but are little used except by a few trappers. The northern parts of Gundy and Broderick townships are most easily reached by float-equipped aircraft based at Kenora.

Previous Geological Work

The southern part of the map-area was visited by A. C. Lawson (1885) during his survey of the Lake of the Woods area from 1883 to 1885. Parsons (1912) examined the rocks in the vicinity of the Ontario-Manitoba border, from Shoal

[1]Canoe Lake is southwest of Echo Bay, just outside the present map-area.

Lake to Ingolf. The only later work was that of Leonard Greer (1931), who mapped the Shoal Lake area in 1929 at a scale of 1 inch to 1 mile. To the east, the north-central part of the Lake of the Woods area was mapped by Jas. E. Thomson (1937a). The adjacent area of Manitoba was mapped at a scale of 1 inch to 1 mile by G. D. Springer (1952), and part of this area was subsequently mapped by J. F. Davies (1954) at a scale of 1 inch to 1,000 feet. Geological data by mining companies has been included in this report and map.

Topography

The maximum relief within the area mapped, i.e. between the elevation of Echo Bay and that of the granitic hills of north-central Broderick township, is about 250 feet. Local relief, however, probably does not exceed 100 feet. In general, moderate ruggedness of topography persists throughout the map-area, though sand and clay flats are more common in the south half.

Drainage is fairly well developed. A minor height-of-land approximately coincides with the pipeline road. South of this, drainage is into Shoal Lake and Lake of the Woods. Between the pipeline road and the Canadian Pacific railway (approximately), drainage is into the Whiteshell River system. The northernmost part of the map-area drains via Rice Creek and Cygnet River directly into Winnipeg River. Streams dammed by beaver are common in most of the area, resulting in some modification of the topography. Low ground, which was flooded at the time of the present survey, is indicated on the accompanying maps (Nos. 2068, 2069, back pocket).

Outcrop of bedrock is abundant, particularly in the two northern townships and the area adjacent to High Lake. Most of the higher ground consists of bedrock with or without a light cover of drift and moss, therefore the outlines of outcrop areas on the accompanying maps more correctly show areas of higher ground. This has the advantage of indicating prominent linear features represented by valleys.

Natural Resources

AGRICULTURE

Adjacent to Shoal Lake there are some small flat areas in which lake clays have been deposited. Up to 3 inches of black soil lies on top of the clay in places, and though there has never been any attempt to cultivate the soil, it is felt that some gardening could be undertaken. These areas lie mostly within Indian Reserve 39a.

FORESTS

Much of the area has at some time supported logging operations. In recent years parts of Forgie and Glass townships have been the site of logging operations, and in 1961 and 1962 a camp and sawmill were located just south of Crowduck Lake.

The type of growth varies considerably from place to place. Jackpine, spruce, and balsam probably constitute about half of the total, with jackpine predominating. Poplar is abundant throughout the area; birch and cedar are locally abundant. Ash, alder, and, less commonly, willow and tamarac are found in wet areas; hazelbrush is found in some of the drier areas.

Blueberries and wild rice are important sources of income to the local Indians. The wild rice is mostly confined to parts of Rush Bay and eastern Crowduck Lake.

A number of small forest fires and two larger forest fires have occurred in the area. In 1929 over 5 square miles of Gundy township and a larger area of Rice township to the north were devastated by fire. In 1936 a fire spreading east from Manitoba burned along the south side of High Lake and extended as far as the south tip of Electrum Lake.

GAME AND FISH

Commercial fishing, chiefly for pickerel, is carried out on Shoal Lake by the Indians. Almost all parts of the area are fished by tourists. Pickerel and northern pike are the main game fish. Lake trout, whitefish, perch, and bass are found in some lakes.

Beaver and mink account for over 90 percent of the fur-bearing animals trapped in the area; fisher, weasel, muskrat, and lynx are also found. Rabbits are abundant in most parts of the area.

Moose, deer, and bear are found in all parts of the area. The moose and deer appear to be most numerous north of the Canadian Pacific railway. Partridge are found throughout the area, and a variety of ducks frequent many of the lakes, especially where wild rice is found.

INHABITANTS

The only permanent residents of the area live at Ingolf. Immediately south of the map-area, however, about 375 treaty Indians, in two bands, live on the Reservations. A trading post is maintained at the end of the Shoal Lake road.

During the summer months many tourists visit the area. Cottages are located at many lakes, especially Longpine, Royal, and Moth lakes and Lake of Two Mountains.

General Geology

The bedrock of the area is all of Precambrian age. Most of the volcanic rocks can, with some degree of confidence, be ascribed to the Keewatin, inasmuch as they are part of a great sequence of dominantly volcanic rocks, in the Lake of the Woods area, to which Lawson originally assigned the name Keewatin. The volcanic rocks and certain sedimentary rocks have been intruded by a variety of acid stocks and batholiths and a few basic stocks, sills, and dikes.

Unconsolidated glacial deposits, largely unsorted till, occur throughout the area and are of Pleistocene age. Clays near Shoal Lake and Lake of the Woods may be late Pleistocene or Recent in age.

In the early work of Lawson (1885) the rocks were, in general, grouped according to their mineralogical composition. This was satisfactory at that time because it successfully outlined broad areas considered to be favourable for prospecting. Parsons (1911; 1912) used Lawson's terms, but he attempted in his maps to be more specific with regard to the origin of the rocks. Greer (1931) used a classification based entirely on rock origin, but found that the scale of mapping did not permit the separation of narrow bands and lenses of differing rock types.

TABLE OF FORMATIONS

CENOZOIC

RECENT Lake, stream, and swamp deposits.
PLEISTOCENE Sand, gravel, clay.

PRECAMBRIAN

PROTEROZOIC Diabase.

Intrusive Contact

ARCHEAN

Later Acid Intrusive Rocks

Pink quartz monzonite and granodiorite, with some grey foliated granodiorite.

Intrusive Contact

Quartz monzonite; grey granodiorite; gneissic hornblende-biotite granodiorite, with aplite, pegmatite, and dark inclusions; grey granodiorite with much pink granodiorite; tonalite and diorite[1]; border phase of hybrid rocks and *lit par lit* gneiss; granodiorite with large feldspar "eyes".

Intrusive Contact

Crowduck Lake Group

Argillite and cherty argillite; arkose, arkosic greywacke, impure sandstone (tuff?); conglomerate; reworked agglomerate; volcanic rocks.[2]

Unconformity

Earlier Acid Intrusive Rocks

Porphyritic intrusive rocks; porphyritic granodiorite; quartz porphyry; feldspar porphyry.

Intrusive Contact

Basic Intrusive Rocks

Quartz-hornblende diorite; hornblende diorite; diorite with much injected granodiorite; gabbro.

Intrusive Contact

Keewatin Group

Metasediments: Arkose[3]; greywacke, arkosic greywacke (tuff); conglomerate, reworked agglomerate; iron-rich greywacke; slate, iron-rich slate; siliceous siltstone, cherty sedimentary rocks (tuff); garnet-rich greywacke.

Acid Volcanic Rocks[3]: Bedded rhyolitic and dacitic tuff, minor flows and agglomerate; massive fine-grained rhyolitic and dacitic tuff; porphyritic (quartz) rhyolite flows with minor tuff, agglomerate, and quartz porphyry dikes; rhyolitic agglomerate.

agglomerate; massive fine-grained rhyolitic and dacitic tuff; porphyritic

Intermediate Volcanic Rocks[3]: Andesite; porphyritic andesite; andesite-dacite agglomerate; andesite-dacite tuff, agglomerate and flows.

Basic Volcanic Rocks[3]: Andesite; basalt; tuff, lapilli tuff; agglomerate and tuff; interbanded lensy tuff, flows and sediments; hornblende-biotite-plagioclase schist; gabbro, coarse-grained tuff and flows (possibly gabbro).

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[1]Some of these rocks may be older than the upper sedimentary unit.

[2]Part of the volcanic rocks may belong to the Keewatin group.

[3]The basic, intermediate, and acid volcanic rocks, and the metasediments are interbanded.

During the present survey every attempt has been made to separate units consisting of a single rock type, but the problem of interfingering has made it necessary to generalize in many places.

Keewatin Group

Most of the volcanic and sedimentary rocks of the map-area are assigned to the Keewatin group. This terminology is the same as that used in describing the Precambrian geology of Minnesota (Goldich *et al.* 1961).

Volcanic rocks predominate; these include flow rocks and pyroclastic rocks of basic, intermediate, and acid composition. The distinction between fine-grained pyroclastic rocks and true sedimentary rocks is difficult, and it is probable that normal sedimentation processes were involved in deposition of some of the pyroclastic rocks.

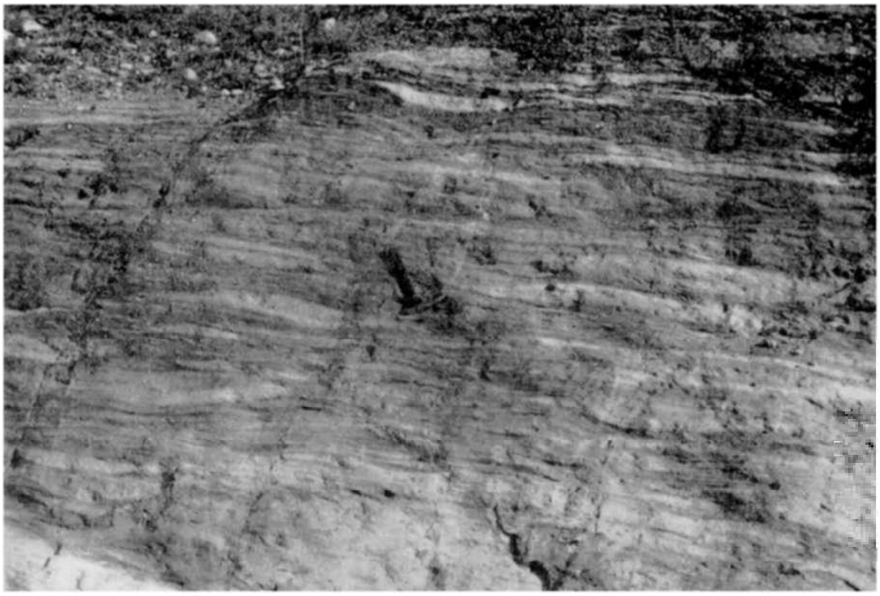
BASIC VOLCANIC ROCKS

Flow rocks of basaltic composition are the only significant extrusive rocks in the broad zone that surrounds High Lake. These rocks are generally massive, fine-grained, and structureless, though coarser phases were noted and pillow structures seen in a number of places. The rocks weather greenish black to very dark grey and are composed of fine hornblende and plagioclase with minor biotite, magnetite, and epidote. Basaltic flows and pyroclastic rocks are common in the vicinity of Baubee Lake and south of the Crowduck Lake–Rush Bay lineament, but are interbedded with intermediate and acid volcanic rocks.

Basalts were rarely noted east of the Shoal Lake road. An exception is the northernmost band of volcanic and sedimentary rocks, where flows, tuff, and greywacke are intimately interbedded. Thin lenticular beds and flows are characteristic of this band (Photo 1), and in places considerable difficulty was encountered in distinguishing the volcanic rocks from the sedimentary rocks. Hornblende, biotite, and plagioclase are the three main minerals present in these fine-grained rocks, and the banding is effected by variations in their proportions. Coarse garnets are abundant in some beds. A peculiarity of the rocks in this band is the silicification, which has taken place adjacent to joints and irregular cracks, particularly in the darkest (volcanic?) beds. The silicified zone, commonly at a large angle to the bedding, stands in relief on the weathered surface. In Photo 2, the narrow silicified zone adjacent to a joint can be seen to the right of the pencil point.

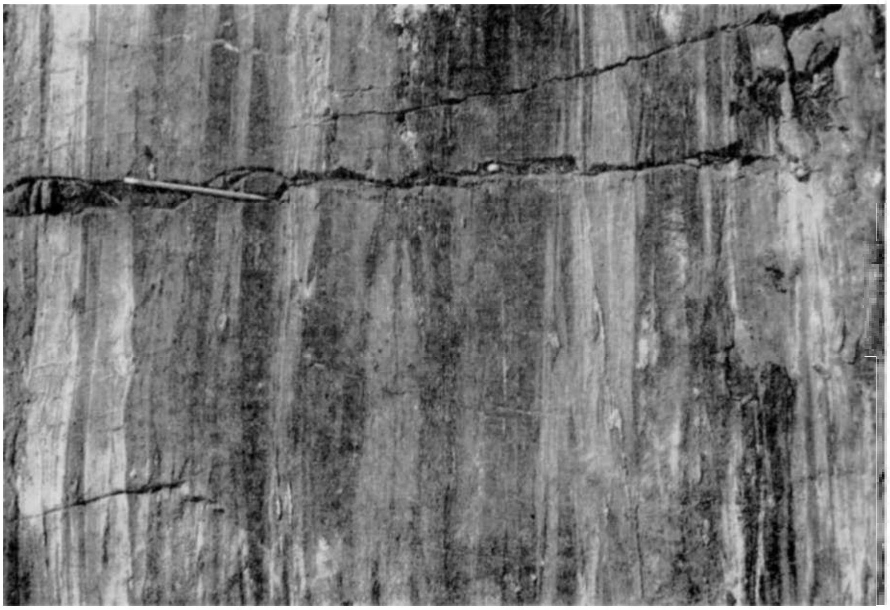
The large area of basic pyroclastic rocks that lies south of Baubee Lake is very similar in appearance to gabbro, and may include some gabbro. The true pyroclastic nature of part of this rock can be observed in some well-exposed outcrops (especially near the southwest shore of Baubee Lake), where large and small volcanic bombs are outlined on the weathered surface. One zone, containing fine-grained, lighter-coloured lapilli (recrystallized feldspar) in a dark, fine-grained matrix of biotite, feldspar, and minor calcite and amphibole (Analysis No. 1, Table I), is similar chemically to gabbro except for a high alumina and potash content. An altered basic tuff (Analysis No. 2, Table I) from Indian Bay, Shoal Lake, is shown for comparison. In other parts of the map-area, especially west and southwest of Lake of Two Mountains, the true origin of the gabbroic rock has not been determined.

Photo 1



Lenticular intermediate and basic volcanic flows, Trans-Canada Highway, south of Hertz Lake.

Photo 2



Interbanded lenticular volcanic and sedimentary rocks, northeast of Royal Lake.

Photo 3

Volcanic flow breccia, island in Indian Bay, Shoal Lake.

Photo 4

Typical dacitic agglomerate, south of Lake of Two Mountains.

TABLE I—CHEMICAL ANALYSES OF SAMPLES OF VOLCANIC ROCKS

	Analysis No.					
	1	2	3	4	5	6
SiO_2	49.63	48.65	74.08	75.21	73.00	73.84
Al_2O_3	22.61	12.94	12.12	12.31	13.46	13.95
Fe_2O_3	1.26	2.26	1.10	0.92	1.07	0.84
FeO	9.99	6.19	1.66	0.91	1.51	1.06
MgO	2.01	8.14	0.50	3.00	0.24	0.44
CaO	5.62	8.33	1.40	0.52	0.74	2.16
Na_2O	2.53	3.16	2.40	0.40	0.32	3.77
K_2O	3.29	2.64	3.68	2.98	7.95	1.42
H_2O+	0.95	0.44	0.34	0.96	0.23	0.18
H_2O-	0.01	0.18	0.20	0.23	0.09	0.03
CO_2	0.64	4.66	2.51	2.00	0.95	1.12
TiO_2	1.54	1.00	0.47	0.13	0.22	0.19
MnO	0.17	0.14	0.07	0.01	0.02	0.03
Cr_2O_3	<0.01	0.05	<0.01	<0.01	<0.01	<0.01
V_2O_3	0.03	0.02	<0.01	<0.01	<0.01	0.01
Total	100.28	98.80	100.53	99.58	99.80	99.04
Specific Gravity	2.85	2.85	2.70	2.72	2.63	2.77

Analysis No.
1. Basic lapilli tuff; pipeline road south of Baubee Lake.
2. Altered basic tuff; small island in Indian Bay, Shoal Lake.
3. Altered, very fine-grained rhyolite; near south shore of Crowduck Lake.
4. Slightly sheared porphyritic (quartz) rhyolite containing rare lapilli; northeast Darkwater Lake.
5. Very fine-grained rhyolite; south of west end of Crowduck Lake.
6. "Crystal tuff" within acid volcanic sequence; pipeline road southeast of Baubee Lake.

West of Baubee Lake and in the area north of Shoal Lake, andesitic flow rocks are abundant. These have a grey weathered surface and a more siliceous-looking fresh surface. Flow breccia (Photo 3) and pillow structures are more abundant in the andesitic rocks than in the basaltic rocks.

INTERMEDIATE VOLCANIC ROCKS

The dark greenish grey weathering andesites that occur extensively north of Crowduck Lake in Forgie township are generally fine-grained, but in part contain phenocrysts of feldspar about a millimetre long. This massive andesite is vesicular in places, exhibits some pillow structures, and is distinctly different from the basic flow rocks of western Ewart township.

Intermediate pyroclastic rocks locally form thick bands in the Lake of the Woods area. Within the present map-area a wide band of agglomerate lies adjacent to and south of Lake of Two Mountains. The rock unit can be traced east as far as Kenora and consists of light-grey, siliceous-looking fragments in a dark-grey matrix. The fragments are elongated, but show some angularity (Photo 4). The over-all composition is probably close to dacite, though the fragments are more basic in a few places, and the composition may approximate that of andesite.

ACID VOLCANIC ROCKS

Extrusive acid volcanic rocks constitute major units within the map-area, particularly in Forgie township. Flows, agglomerate, and tuff have been recognized, the tuff predominating.

Porphyritic (quartz) rhyolite, occurring as flows, agglomerate, and tuff, forms prominent ridges in the south-central part of the area. The similarity of this rhyolite to intrusive quartz porphyry dikes has, in the past, caused it to be considered intrusive also. Undoubtedly some dikes do occur within the extrusive rocks, but they constitute a small proportion of the total.

Photo 5

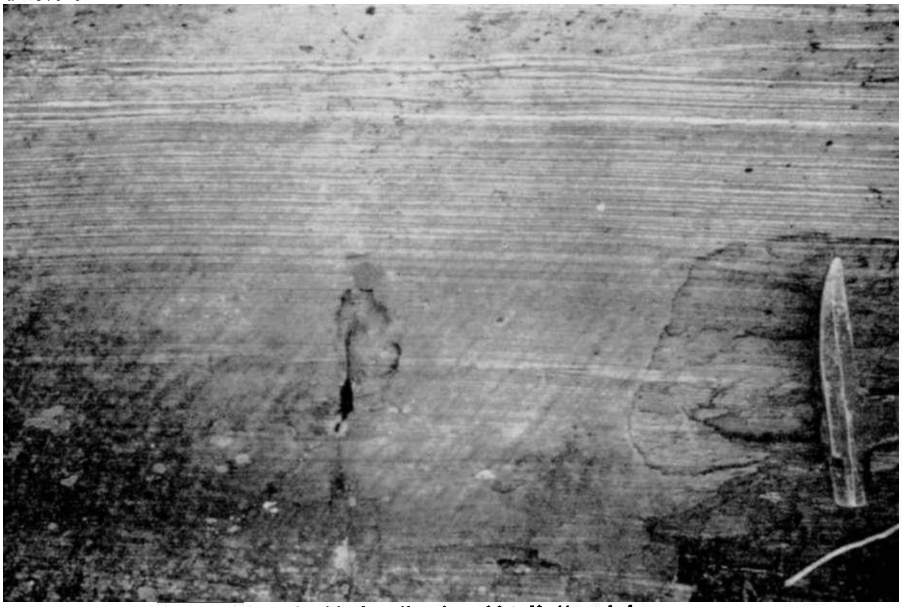
Rhyolitic agglomerate, Rush Bay road, northwest of Chebucto Lake.

Typically the rock weathers creamy white to pale greenish yellow, with some outcrops containing patchy, rusty-orange sections. Quartz eyes, about 2 millimetres in diameter, having a bluish opalescence in places, are abundant. The groundmass weathers grey-white, but is dark and cherty on the broken surface. Agglomeratic fragments show a white bleached border (Photo 5). The sheared rhyolite contains much fine-grained sericite and quartz, and some bleaching along shear planes has resulted in a faintly-banded weathered surface. Analyses of altered rhyolite and porphyritic (quartz) rhyolite are given in Table I (Analyses Nos. 3 and 4) and are compared with massive non-porphyritic rhyolite (Analysis No. 5). The three analyses are all similar, except for the ratio of potash to soda. The extremely high content of potash in Analysis No. 5 is notable.

Rhyolitic and dacitic tuff form large masses in northern Forgie township and in the vicinity of Royal and Baubee lakes. Bedding is typically absent in this buff-grey weathering rock, except along the highway north of Baubee and Moth lakes and south of Royal Lake. The rocks are uniformly fine-grained, but angular fragments can be seen in places.

The interbedding of agglomerate and lapilli tuff supports the conclusion that this rock unit is mainly tuffaceous, but there is little doubt that normal sedimentary rocks occur interbanded in places. Distinction in the field between the sedimentary and tuffaceous rocks is extremely difficult. The tuff (Table II, Analysis No. 7) and massive arkose (Table II, Analysis No. 8) are also almost identical chemically.

Photo 6



Extremely thin banding in acid tuff, Moss Lake.

Photo 7

Weathering along polygonal joint pattern in rhyolite resembles pillows, pipeline road south of High Lake.

TABLE II—CHEMICAL ANALYSES OF SAMPLES OF TUFFACEOUS AND SEDIMENTARY ROCKS

	Analysis No.					
	7	8	9	10	11	12
SiO_2	69.15	70.03	70.70	65.76	53.56	51.51
Al_2O_3	16.04	16.47	15.13	18.64	14.95	16.79
Fe_2O_3	1.42	0.43	0.92	1.36	2.02	9.04
FeO	1.89	1.51	1.97	3.85	13.60	5.60
MgO	0.91	0.65	1.40	1.27	5.44	4.91
CaO	2.15	2.20	1.62	0.44	2.15	7.22
Na_2O	4.67	5.66	3.22	2.59	1.19	1.25
K_2O	1.95	2.17	2.74	1.92	1.93	0.12
H_2O+	0.34	0.12	0.73	2.23	1.68	0.18
H_2O-	nil	0.07	0.24	0.11	0.12	0.02
CO_2	0.77	1.33	0.98	1.01	1.34	0.44
TiO_2	0.65	0.29	0.47	0.70	1.47	2.02
MnO	0.05	0.03	0.05	0.05	0.31	0.54
Cr_2O_3	<0.01	<0.01	<0.01	<0.01	0.03	0.08
V_2O_3	0.01	<0.01	0.02	0.02	0.04	0.08
Total	100.00	100.96	100.19	99.95	99.83	99.80
Specific Gravity	2.65	2.67	2.70	2.68	2.93	2.99

Analysis No.
7. Finely banded acid tuff; highway No. 17, 0.2 miles east of Shoal Lake road.
8. Arkose; about 0.35 miles south of highway No. 17 and 0.5 miles east of Shoal Lake road.
9. Banded cherty argillite; 1.0 mile east of pond in south-central Ewart township.
10. Banded argillite; 0.5 miles southeast of pond in south-central Ewart township.
11. Garnet-mica schist (greywacke); 0.3 miles north of new highway, near North Creek.
12. Amphibole-garnet greywacke; south shore, central Royal Lake.

A very peculiar "crystal tuff" is present with the massive fine-grained rocks southeast of Baubee Lake, and is exposed on the pipeline road just east of the old High Lake wagon trail. It consists of plagioclase crystals up to 2 inches long, cracked and altered to sericite, carbonate, and albite, set in a dark matrix of biotite and minor magnetite and quartz. An analysis (Table I, Analysis No. 6) shows that this rock is not greatly different in composition from normal rhyolite.

Cherty, pale yellowish-green rock considered to be rhyolite is present northwest of Crowduck Lake and is exposed along the Shoal Lake road. Very contorted, minutely banded rock was noted in one place. Possibly the rock is a true rhyolite containing some thinly banded tuff similar to that seen on the southwest shore of Moss Lake (Photo 6). Banded siliceous rocks associated with acid volcanic rocks occur in other places (notably on the largest island in Crowduck Lake) and probably are tuffaceous in origin.

SEDIMENTARY ROCKS

Within the Keewatin group the sedimentary rocks are intimately associated with the volcanic rocks. These rocks are almost wholly of clastic origin and include numerous lenses of volcanic rocks.

The most important sedimentary rocks, quantitatively, are arkose and arkosic greywacke. These occur in a band extending from West Hawk Lake to Royal Lake where they grade into, or are interbedded with, acid volcanic rocks. It has already been pointed out that the arkose and the acid tuff are almost indistinguishable both in the field and chemically, and it is probable that the arkose is largely derived from tuff. Typically the buff-weathered surface of the arkose exhibits very little bedding. Individual grains have a rounded appearance, but this may be a metamorphic effect. Fragments of quartz and plagioclase are seen, microscopically, to be set in a fine-grained groundmass of quartz, feldspar, sericite, and biotite, with small amounts of secondary carbonate and potash feldspar. With increasing content of groundmass material, particularly biotite, the rock grades into arkosic greywacke and greywacke.

Greywacke weathers darker and has a more schistose appearance. Some semblance of bedding can generally be detected. In the area of the Shoal Lake road and the pipeline road, dark hornblende is an important constituent of the greywacke and occurs in irregular elongate patches, which appear to mark original bedding. The amphiboles in places show pseudo-graded bedding, probably being larger in the lime-rich parts of an individual bed and smaller in the lime-poor part.

Where iron is an important constituent garnets are normally found. A dark-weathering, garnet-mica schist from the Royal Lake area was analyzed (Table II, Analysis No. 11) and compared with a very light-coloured amphibole greywacke, which contained minute red garnets (Table II, Analysis No. 12). Both are iron-rich, and the main difference seems to be the amount of lime and potash. Very fine-grained black slate at the Provincial boundary contains about 15 percent magnetite and small red garnets. Iron-rich sedimentary rocks are not important quantitatively.

Very few conglomerate beds were noted within the Keewatin group. Along the western part of the prominent linear feature north of High Lake, coarse fragmental rocks occur, which strictly speaking are probably conglomerates. The fragments are exclusively volcanic, however, and the rock has been called a reworked-agglomerate. A thin band of similar reworked-agglomerate is present southeast of Electrum Lake. Conglomerate occurs within a rusty arkosic greywacke horizon near Whiteshell River, just east of the Provincial boundary, and this may be an intraformational conglomerate.

Cherty sedimentary rocks have been described by Thomson (1937a, pp. 11–14) and Greer (1931). The association of these rocks with fragmental volcanic rocks in the Shoal Lake area was noted by Greer (1931, p. 46), and the few cherty sedimentary rocks of the Keewatin group in the present map-area appear to have a similar relationship. Cherty sedimentary rocks west of Crowduck Lake are adjacent to rhyolitic rocks. Cherty bands in greywacke southeast of Hopkins Lake in Forgie township appear closely related to acid tuff.

Basic Intrusive Rocks

Coarse-grained rocks, weathering very dark-grey to black, consisting essentially of hornblende and altered plagioclase, occur in many parts of the map-area. Some of this rock has been definitely identified as basic flows, tuff, and agglomerate, and it has been a problem to distinguish the truly intrusive rocks from the extrusive rocks. Where considerable doubt remained after the field mapping was completed, the rocks were included with extrusive units.

One area underlain by basic intrusive rock is located near the south bay of High Lake. This rock (Table III, Analysis No. 13) consists of large amphibole grains enclosing laths of altered labradorite. Some alteration to epidote, magnetite, and chlorite has occurred in this coarse-grained gabbro. Similar lens-like bodies of gabbro were noted within the basaltic rocks south of High Lake, and these are all believed to be sills or dikes closely related in age to the basalt.

Along the pipeline road just east of the Provincial boundary the rock is coarse-grained and microscopically very similar to the High Lake gabbro described above. Chemically (Table III, Analysis No. 14) it is not significantly different and can be termed gabbro. Rock very similar in appearance is present both south and north of Baubee Lake, but only to the north has the rock been called gabbro, because the extrusive nature of the rock to the south is clearly shown in a number of outcrops.

Within the large area of granodiorite in northern Gundy township, dark, coarse-grained rocks occur that are older than the enclosing granodiorite. Compositionally there is some variation from place to place, but plagioclase (andesine), hornblende, biotite, and quartz can be recognized in most specimens. There has been considerable reaction between this plagioclase-amphibole rock and the adjacent granodiorite, particularly along the south contact. South of McQuaker Lake the older rock has been completely digested in places, and can be traced along strike into biotite-rich granodiorite. Two specimens were taken (Table III, Analyses Nos. 15 and 16) representing the freshest-looking zone and a partly altered zone respectively. Both microscopically and chemically the addition of silica and potash seems apparent. The rock is mostly dioritic.

TABLE III—CHEMICAL ANALYSES OF SAMPLES OF BASIC IGNEOUS ROCKS

	Analysis No.				
	13	14	15	16	17
SiO_2	47.57	45.95	59.98	62.34	52.73
Al_2O_3	16.51	15.02	14.95	15.69	15.60
Fe_2O_3	1.93	3.53	2.07	2.62	5.70
FeO	10.12	14.42	4.39	3.32	2.42
MgO	7.27	4.51	5.22	3.11	7.80
CaO	11.24	9.38	6.19	4.42	7.73
Na_2O	1.40	2.63	3.52	3.64	2.47
K_2O	0.08	0.36	1.36	2.96	1.89
H_2O+	1.39	0.64	0.59	0.53	0.20
H_2O-	0.04	0.02	0.06	0.08	0.21
CO_2	1.20	1.36	0.70	0.54	2.24
TiO_2	0.99	1.90	0.65	0.72	0.75
MnO	0.18	0.26	0.10	0.07	0.11
Cr_2O_3	0.05	<0.01	0.06	0.02	0.09
V_2O_3	0.05	0.03	0.02	0.02	0.03
Total	100.02	100.01	99.86	100.08	99.97
Specific Gravity	3.02	3.11	2.80	2.76	2.87

Analysis No.
13. Altered gabbro; south of south bay of High Lake.
14. Altered gabbro; pipeline road, 0.8 miles east of the Manitoba provincial boundary.
15. Hornblende diorite; near south shore of western part of McQuaker Lake.
16. Quartz-hornblende diorite; 0.2 miles south of west end of Whitefish Lake.
17. Diabase dike; near Shoal Lake road west of Electrum Lake.

Rock very similar to the above occurs in northeastern Broderick township as a number of separate zones. Possibly these zones are remnants of an original larger dioritic body, which was intruded by the granodiorite.

South of the Crowduck Lake–Rush Bay linear feature numerous gabbroic dikes occur parallel to the schistosity of the enclosing rocks. These dikes appear to be associated with a late stage of structural deformation. Mineralogically they consist of coarse amphibole and altered feldspar. Magnetite is sufficiently concentrated in some of the dikes to produce magnetic anomalies.

Earlier Acid Intrusive Rocks

The relative ages of the acid intrusive rocks will be discussed after a brief description of all of the distinct units. At this point it is sufficient to state that at least one pre-Timiskaming (Laurentian) unit is known to be in the map-area, and that this unit is the most important from the viewpoint of economic geology.

HIGH LAKE PORPHYRITIC GRANODIORITE AND RELATED DIKES

Porphyritic granodiorite, usually referred to simply as porphyry, forms a large mass north and east of High Lake. The medium-grey-weathered surface of the least-altered porphyry and the yellowish grey to rusty-tinted weathered surface of the more highly altered porphyry are both characterized by numerous quartz eyes having a bluish opalescence, and rare large microcline phenocrysts. White feldspar grains, approximately equal in size to the quartz grains (1–3 mm.), are abundant in the least altered rock. The schistose, fine-grained groundmass consists of sericite and quartzo-feldspathic material and contains minor carbonate, epidote, and magnetite. The large (10–15 mm.) microcline phenocrysts are clearly primary, and enclose well-formed, slightly sericitized plagioclase crystals. In the least-altered rock, similar well-formed plagioclase crystals form "eyes" in the schistose groundmass together with strained quartz.

The outcrop pattern of the porphyry suggests that the volcanic "inclusions" are stoped blocks within the intrusive mass, but it is probably more correct to consider the porphyry as dikes intruded into the volcanic rocks. Nevertheless, remarkable uniformity of composition is apparent in two specimens (Analyses Nos. 20 and 21, Table IV), taken a mile apart.

Where dike rocks are isolated in volcanic rocks they are referred to as quartz porphyry, but they appear to be similar in composition to the porphyritic granodiorite. Darker dikes, called feldspar porphyry, occur in numerous places in the north High Lake region and may be related to the porphyritic granodiorite. These darker dikes, consisting of feldspar grains in a dark, fine-grained groundmass, are generally narrow and have not been distinguished in the present mapping.

Porphyritic dikes in the Echo Bay area vary from quartz-feldspar porphyry to feldspar porphyry (with very minor quartz). The quartz is strained, and the feldspar slightly sericitized, similar to the High Lake porphyry. The Echo Bay dikes appear to conform to the pronounced east-west shearing direction, presumed to be a late-stage feature, though two periods of shearing in the same direction is a possibility.

Crowduck Lake Group

The conglomerates of Crowduck Lake were first described by Greer (1931, p. 47), who considered them to represent a local accumulation within the Keewatin. Similar but less coarse conglomerates were found by Thomson about 10 miles east and were considered by him to be of Timiskaming age (Thomson 1937a, p. 16). The recognition of a pre-conglomerate granite within the present map-area points to a Timiskaming age for the Crowduck Lake group.

Included in this group are conglomerate, arkose, argillite, cherty argillite, agglomerate, reworked agglomerate, and andesite. Thus the rocks differ from those found by Thomson (1937a, p. 17) in the absence of quartzite and the presence of volcanic rocks. It is possible that all or part of the volcanic rocks belong to the Keewatin group.

The conglomerate includes boulders, cobbles, and pebbles of granitic and volcanic rocks. At least two types of granitic rocks occur: the one porphyritic (definitely established as the High Lake porphyritic granodiorite) and the other massive and uniform. The volcanic rocks are of many varieties; the abundance in places of vesicular andesite suggests the possibility of volcanic activity at the time of the formation of the conglomerate.

Greer (1931, p. 47) has recorded the variety of pebbles, and the number of each found, at one well-exposed outcrop on the north shore of Crowduck Lake. At this locality pebbles are dominantly granitic, but elsewhere are dominantly volcanic. Some correlation was noted between the abundance of pebble rock-types near the base of the group and the underlying rock. At one point (north-east of the A-D property) a brecciated zone of porphyry lies between the underlying massive porphyry and the overlying pebbly arkose.

Arkose is abundant and, in general, overlies conglomerate. It is very massive and almost indistinguishable from massive porphyry. In the field, close examination of the arkose revealed a few minute subangular fragments, and of course the large feldspar phenocrysts are absent. In thin section the clastic nature of the arkose is fairly clear. An analysis of arkose (Table IV, Analysis No. 22) shows great similarity to that of the porphyry (Table IV, Analyses Nos. 20 and 21).

Fine-grained, grey-banded argillite and cherty argillite with fine-grained interbanded arkose (acid tuff?) underlies a large area north of Crowduck Lake. Isoclinal folding is seen in places, and slaty cleavage is normally at an angle to the bedding. The bands are partly very siliceous, standing in slight relief on the weathered surface, and they have been called cherty argillite. Two analyses (Table II, Analyses Nos. 9 and 10) point to differences between the cherty argillite and the argillite.

The inclusion of agglomerate (and flows) in this group may not be justified, but appears necessary from the structural data known at present. The abundance in places of vesicular andesite has been pointed out, and it is convenient to consider the conglomerates containing exclusively volcanic pebbles (mostly andesitic, some more acid) as being reworked agglomerates. One outcrop along the Shoal Lake road just north of the Crowduck Lake landing contains a rounded boulder 12 feet long and 3 feet wide, but this is exceptional.

All dips are steep in these younger sedimentary rocks, and though a small diabase dike was noted in the arkose, granitic intrusions have not been definitely identified as cutting the group. Similar relations were found by Thomson (1937a, p. 19).

Later Acid Intrusive Rocks

HIGH LAKE TONALITE

The rock mapped as tonalite weathers very dark grey and consists of zoned andesine, pale-green hornblende, and strained quartz. The feldspar is slightly altered to a clay mineral and epidote; the hornblende is highly altered to brown biotite. A little magnetite and microcline occur in the rock. An analysis is given in Table IV, Analysis No. 18. The term tonalite has been applied since quartz is very subordinate, and dark minerals are abundant.

Photo 8

Brecciated tonalite injected by pink granodiorite, southwest of High Lake.

The tonalite occurs in a brecciated zone into which has been injected considerable light-coloured granitic material (Photo 8). Nevertheless, the contact between this rock and the pink granodiorite is relatively sharp. A lighter grey, possibly hybrid, rock has been included with the tonalite, in the mapping.

HIGH LAKE PINK GRANODIORITE

The massive, medium- to coarse-grained, pink-weathering granodiorite, which lies between the tonalite and the basic volcanic rocks near the south shore of High Lake, consists of zoned plagioclase (andesine-oligoclase), microcline, and strained quartz. The plagioclase, which constitutes about 60 percent of the rock, is partly altered to sericite and epidote, and very slightly replaced at the edges by microcline. Biotite, magnetite, and sphene are accessory minerals. Part of the microcline occurs as phenocrysts.

TABLE IV—CHEMICAL ANALYSES OF SAMPLES OF ACID IGNEOUS ROCKS AND ONE DERIVED SEDIMENT

	Analysis No.					
	18	19	20	21	22	23
SiO_2	57.72	69.60	70.79	70.83	68.97	70.36
Al_2O_3	14.44	16.19	16.39	16.37	16.48	16.51
Fe_2O_3	1.76	1.60	0.83	0.99	1.34	1.43
FeO	4.68	0.98	0.83	0.76	2.65	0.68
MgO	7.36	0.72	0.51	0.67	1.47	0.58
CaO	6.08	2.08	1.28	1.67	1.90	1.56
Na_2O	2.80	4.63	5.46	3.83	4.08	4.55
K_2O	1.88	2.87	2.60	2.86	1.72	2.95
H_2O+	0.44	0.09	0.34	0.47	0.50	0.26
H_2O-	0.09	0.18	0.04	nil	0.04	0.04
CO_2	1.76	0.56	0.09	0.98	1.02	0.39
TiO_2	0.55	0.26	0.19	0.18	0.36	0.20
MnO	0.16	0.06	0.02	0.05	0.03	0.02
Cr_2O_3	0.07	<0.01	<0.01	<0.01	0.02	<0.01
V_2O_3	0.02	<0.01	<0.01	0.01	0.01	<0.01
Total	99.81	99.82	100.27	99.67	100.59	99.53
Specific Gravity	2.84	2.66	2.65	2.66	2.70	2.65

Analysis No.
18. Tonalite; provincial boundary southwest of High Lake.
19. Pink granodiorite; west of south bay of High Lake.
20. Porphyritic granodiorite; west of south tip of Electrum Lake.
21. Porphyritic granodiorite; a mile north of eastern High Lake.
22. Arkose; 0.4 miles east of Shoal Lake road at junction with trail to High Lake.
23. Pink granodiorite; north shore of Shoal Lake, near east boundary of Indian Reserve.

The rock is more highly altered than would be expected from the appearance of the weathered surface. All of the mica is probably secondary. It is possible that boulders of this rock occur in the conglomerate of the Crowduck Lake group. An analysis of the High Lake pink granodiorite is given in Table IV, Analysis No. 19.

INDIAN RESERVE PINK GRANODIORITE

The pink granodiorite that lies almost wholly within Indian Reserve 39a is very similar to the High Lake pink granodiorite, both mineralogically and chemically (Table IV, Analysis No. 23). The weathered surface of the rock is light-pink and fresh-looking, except near the contact with the volcanic rocks where it is white. Very minor amphibole occurs in the rock; it is largely replaced by green-brown biotite. Sphene, magnetite, and zircon are accessory minerals.

GREY GNEISSIC GRANODIORITE

Most of Broderick township and over half of Gundy township are underlain by grey gneissic granodiorite. There is considerable variation within this rock unit, since foliation is very pronounced in places. The assimilation of hornblende diorite by the granodiorite has been mentioned, and it is very likely that similar assimilation has taken place in other parts of the map-area. Where the dark minerals are concentrated in narrow bands and alternate with light-coloured bands, the rock resembles granitized sedimentary rocks. The proportions of pink granite, aplite, and pegmatite vary considerably from place to place.

Table V—Chemical Analyses of Samples of Acid Igneous Rocks

	Analysis No.					
	24	25	26	27	28	29
SiO_2	67.40	67.16	67.83	67.14	73.16	73.47
Al_2O_3	15.32	16.63	15.67	16.51	14.79	14.85
Fe_2O_3	1.79	1.64	2.62	2.89	1.37	1.79
FeO	2.34	2.72	2.80	2.50	0.90	0.45
MgO	0.94	1.19	1.33	1.13	0.36	0.26
CaO	2.67	3.91	2.56	3.68	1.86	0.72
Na_2O	6.31	4.14	3.74	4.23	3.18	3.25
K_2O	0.48	1.19	2.66	1.30	3.24	5.45
H_2O+	0.65	0.21	0.44	0.28	0.12	0.09
H_2O-	0.09	0.17	0.07	0.10	0.16	0.07
CO_2	2.01	0.47	0.33	0.41	0.50	0.18
TiO_2	0.38	0.59	0.42	0.57	0.23	0.08
MnO	0.07	0.06	0.06	0.06	0.03	0.02
Cr_2O_3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
V_2O_3	0.01	0.01	<0.01	0.01	<0.01	<0.01
Total	100.46	100.09	100.53	100.81	99.90	100.68
Specific Gravity	2.68	2.71	2.70	2.73	2.64	2.62

Analysis No.
24. Porphyry dike; shore of Echo Bay, south of sand bar.
25. Grey gneissic granodiorite; near northeast end of Beauport Lake.
26. Grey gneissic granodiorite; 0.25 miles west of Harvey Lake.
27. Grey gneissic granodiorite; north shore Minkaduza Lake.
28. Pink granodiorite; 0.75 miles south of east end of Harvey Lake.
29. Pink monzonite dike; near south shore of McQuaker Lake, east of portage.

The chief mineral constituents are oligoclase (near andesine), quartz, and biotite, with minor microcline apparently replacing part of the plagioclase. Remnants of hornblende are seen in the least-foliated specimens. Magnetite and sphene are common accessories; apatite and zircon occur in some rocks. Epidote is the main alteration product of the feldspar.

In spite of the variation in rock appearance, the uniformity of composition is remarkable. Three specimens (Table V, Analyses Nos. 25, 26, 27) are from widely separated points. Sample No. 26 is distinctly foliated, with separation of biotite into narrow bands; Sample No. 27 is but slightly foliated; and Sample No. 25 is intermediate in appearance.

One distinct unit within the gneissic granodiorite is worthy of mention; this lies parallel to and south of the hornblende diorite. This rock, dominated by large microcline phenocrysts, occurs in a band 300–400 feet wide, which can be traced for at least 3 miles. The large phenocrysts enclose and partially replace plagioclase crystals. The interstitial material consists of altered oligoclase and biotite, with minor magnetite, epidote, and sphene. The origin of this unusual rock is not clear.

WINNETKA LAKE STOCK

Closely related in general appearance to the gneissic granodiorite is the dominantly granodioritic stock that occurs in northern Forgie township. In the field the relative proportions of plagioclase, microcline, quartz, and biotite (plus hornblende) can be estimated; and a variation, from granite in the centre to hornblende diorite at the edges, was suspected near Spitsi Lake. To the east the variation is less obvious, and the average composition is probably granodiorite to quartz monzonite. The average mineral composition of two specimens taken east of Winnetka Lake is: andesine 41.5 percent, microcline 13.6, quartz 29.5, biotite 8.4, hornblende 2.0, epidote 3.5, sphene 1.0, magnetite 0.3, and apatite and zircon each 0.1 percent.

Photo 9

Nature of contact between the Winnetka stock and adjacent basalt, Trans-Canada Highway, south of Winnetka Lake.

The hornblende-rich border phase, particularly at the north contact, suggests some assimilation of country rock. Inclusions are lens-shaped but sharp, and the intrusive nature of the stock is clear from the contact zone (Photo 9).

PINK QUARTZ MONZONITE AND RELATED DIKES

A number of areas within the mass of gneissic granodiorite were distinguished by being more massive and dominantly pink in colour. Coarse oligoclase and microcline with interstitial quartz and minor biotite are the main minerals present, some microcline having replaced edges of the oligoclase. An analysis of typical pink granodiorite is given in Table V, Analysis No. 28.

The similarity of the rock to pink sugary dikes and aplitic dikes suggested an igneous origin. Examination of a contact between a dike and grey gneissic granodiorite revealed that the texture is uniform across the contact, and that there is present a narrow white contact zone, which is devoid of both biotite and microcline, minerals characteristic of the grey granodiorite and pink quartz monzonite respectively. A metasomatic origin for some of the pink quartz monzonite is suspected.

A large dike of medium-grained quartz monzonite (Table V, Analysis No. 29) clearly cuts the diorite south of McQuaker Lake and points to the igneous origin of some of the pink rocks. Pink dikes are most abundant near contacts, for example south of McQuaker Lake and near the contact on Gundy Lake, but they are found throughout the area. Pegmatites similarly are present throughout the area of pink and grey granodiorite, but they are most common in the vicinity of the highly foliated granodiorite, such as the vicinity of Longpine Lake.

RELATIVE AGES OF ACID INTRUSIVE ROCKS

Lawson (1885, p. 100) considered the granitoid gneisses to be Laurentian in age and the small stocks of granite to be Algoman in age. Parsons (1912, p. 200) significantly considered the rocks in the vicinity of High Lake to be older (Laurentian) along with the northern gneisses, but considered the Indian Reserve granodiorite to be younger (Algoman). Greer (1931, p. 49) tentatively assigned all the granites of the Shoal Lake area to the Algoman period. Thomson (1937a, p. 19) recognized the need for a pre-Timiskaming granite, but felt that the granitic rocks in the area he mapped were of Algoman age.

In the present map-area the High Lake porphyritic granodiorite has been established as pre-Timiskaming in age. There is some evidence that the High Lake tonalite and pink granodiorite are older than the porphyritic granodiorite, and Brown (1962, p. 3) describes inclusions in the porphyritic granodiorite that are very similar to the other two intrusive rocks of the High Lake area. Chemically the pink granodiorite and the porphyritic granodiorite are very similar, and the reluctance to place the former in the pre-Timiskaming group is based simply on the degree of metamorphism and general appearance, and on the lack of conclusive proof that boulders of the pink granodiorite exist in the Crowduck Lake group.

It is tempting, on the basis of appearance and chemical composition, to equate the High Lake pink granodiorite with the Indian Reserve pink granodiorite and with the pink biotite granite described by Thomson (1937b, p. 46) from near Dominique Island,[1] Shoal Lake. If all, or any, of these massive pink granitic rocks can be proved to be pre-Timiskaming, it will bear on the further mapping of the granitic rocks of the Lake of the Woods area, especially if, as seems likely, the gneissic rocks to the north are later in age (Algoman).

Diabase

Diabase dikes in the area are small, and possibly many have been missed in the field mapping. One dark, fine- to medium-grained dike (Analysis No. 17, Table III), about 10 feet wide, was noted cutting arkose of the Crowduck Lake group. This rock consists of highly altered feldspar, and amphibole that has been largely altered to biotite. Similar rock was noted at the northwest end of the long shallow bay off Indian Bay, Shoal Lake, but its age is less clearly defined.

Diabase has been reported near the molybdenum-bearing veins of Evenlode Mines Limited, but possibly the dark rocks referred to are volcanic inclusions.

[1]Outside map-area.

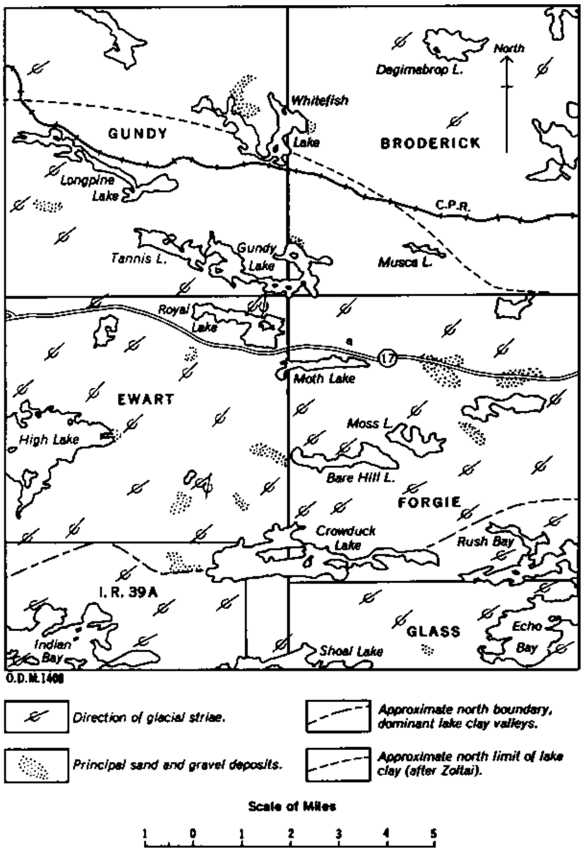


Figure 2 — Some Pleistocene features of the map-area.

Pleistocene and Recent

The more important Pleistocene deposits in the map-area are shown in Figure 2. These consist of broad outwash plains near Lake of Two Mountains, west of Bare Hill Lake, west of Crowduck Lake, and south of the pond in south-central Ewart township. Other deposits are small and represent accumulations in the glacial lee of rocky hills.

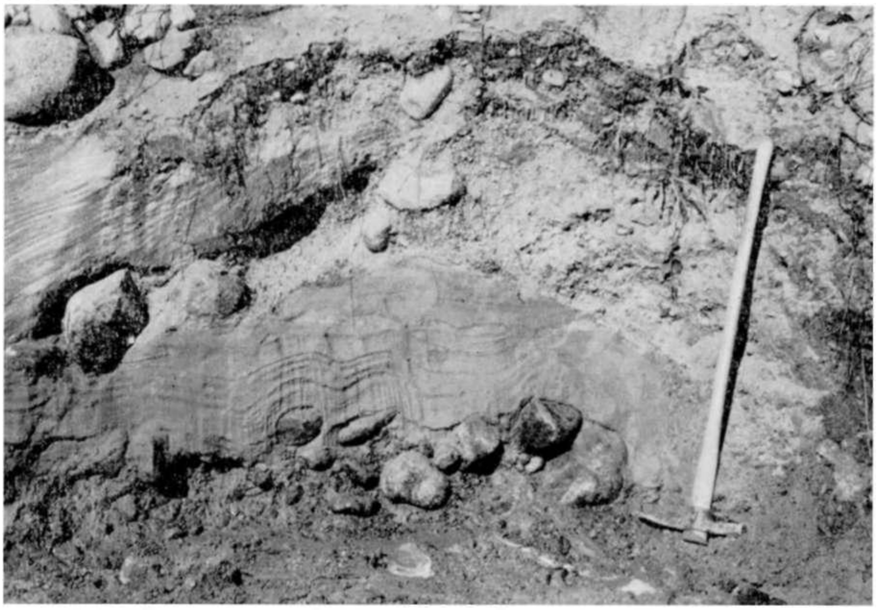
A broad picture of the glacial history of northwestern Ontario is given in a paper by Zoltai (1961). He refers to the outwash plains near Lake of Two Mountains, considering it possible that they represent the northwestern extension of a major terminal moraine.

Unsorted deposits predominate in the map-area. It is improbable that any sequence of events could be established from the exposures in the gravel pits of the area, except possibly that fine-bedded sand is common near the top of most pits. The extremely irregular nature of the bedding and the diversity of material characteristic of the area is exemplified in Photo 10.

Clay deposits are abundant in relatively flat areas adjacent to Shoal Lake, Rush Bay, and Echo Bay. Farther north these clays occur as pockets in the valleys. The presumed northern limit of such lake clays is shown in Figure 2.

Two directions of ice movement were noted in two places in the area: one (southwest) is dominant throughout the area; and the other (more nearly south) may represent a local deflection or possibly an earlier direction of movement. Extremes in deflection directions can be found along narrow hollows, etc., but are not significant in the broad picture.

Photo 10



Typical Pleistocene gravel deposit, Shoal Lake road, near Trans-Canada Highway.

Recent deposits include: clay, mud, and sand deposited by streams; and muskeg. It is probable that the cumulative total thickness of these deposits does not exceed 15 feet in the map-area.

Correlation of Geology with Aeromagnetic Maps

An airborne magnetometer survey, conducted in 1961 as part of a Federal-Provincial program, included the whole Kenora Mining Division. The interpreted results from the present map-area are included in maps Nos. 1186G, 1187G, 1191G, and 1192G, published in 1962 at a scale of 1 inch to 1 mile. Some of the features of the geophysical mapping are discussed below.

A narrow magnetic high of about 400 gammas magnitude extends through the northern part of Indian Bay, Shoal Lake, lies south of Crowduck Lake, and extends along the peninsula between Rush Bay and Echo Bay. Dikes and lens-shaped masses of altered gabbro lie along this zone, which is considered to be one of the more prominent structural features in the Lake of the Woods region.

The area underlain by basic lavas east and south of High Lake is roughly outlined by isomagnetic lines. Three distinct magnetic highs exist in this area. The high southwest of the pond in the south-central part of Ewart township is possibly related to gabbro, and that near the south bay of High Lake is definitely related to gabbro. The magnetic high at the east end of High Lake, the strongest of the three, is probably due to the above-average magnetite content of the porphyry in this locality.

Rhyolitic and dacitic rocks, which constitute a large proportion of the volcanic rocks in Forgie township, are represented by magnetic lows. Some indication of the folding is given by the relationship of magnetic highs and lows in this township.

Close spacing of isomagnetic lines in the sedimentary and volcanic unit that extends from the Manitoba boundary (at West Hawk Lake) to Minkaduza Lake, contrasts with the wider spacing in the granite to the north. A number of magnetic highs close to the contact are probably related to magnetite-bearing sedimentary rocks. Thin gabbroic lenses are present in a number of places along this zone and may have produced the highs; but it is interesting to note that the magnetic low in the vicinity of the Whiteshell River coincides with an area of gabbro.

The large area of altered quartz-hornblende diorite in Gundy township is indicated on the aeromagnetic maps by a series of lows, which, though of low magnitude, outline the diorite remarkably well. Similar rock is present in northeastern Broderick township but was not detected by the geophysical survey.

A number of magnetic anomalies in Broderick township are not satisfactorily explained by the geology as mapped. The close spacing of isomagnetic lines in a zone extending northwest from Monument Lake appears to coincide with a zone of abundant dark inclusions in the granitic rocks. Similar conditions may explain the ridge of highs that cuts across the northeastern part of the township. Though of low magnitude (about 100 gammas), the ridge has remarkable continuity, and it can be traced from Pickerel Lake to the Manitoba boundary, a distance of about 14 miles. At one point west of Dagimabrop Lake, gabbro was noted as a thin skin on a rock face, and it is possible that gabbro occupies a valley in this zone. Outcrop is poor in this area relative to other parts of the township, but if it could be shown that basic intrusions do occur in some valleys the area might be worthy of further investigation.

Structural Geology

The most prominent structural feature in the area is the east-west[1] regional foliation, which is superimposed on other features to some extent in virtually every outcrop in the area mapped. So completely dominant is this foliation, and related structural features, that the tracing of certain beds or horizons (unless in an east-west direction also) is extremely difficult. Folds, other than dragfolds, are rarely detectable in any one outcrop or series of adjacent outcrops; therefore it is only possible to deduce folding from the relationship of certain characteristic rock units to one another over large areas. In parts of the map-area the degree of confidence with which a fold axis is placed on the map is directly proportional to the amount of outcrop in the area of the proposed fold. Where rock units are not distinctly different or, as is common in much of the area, units lens out rapidly, the problem is increasingly complex.

[1]The term "east-west" refers to foliation within 30 degrees of N.80°W.

One of the interesting related structural features is slip folding. This is particularly evident in the well-exposed outcrops along the Trans-Canada Highway. An example is shown in Photo 11, where north-south beds of acid tuff have been displaced by small-scale slippage. Microscopic study of a rock from the same outcrop shows that the vertical component of slippage is even greater than the horizontal component.[1] Such small-scale displacement would not at first seem very important; but a measure of its effect was noted in one road-cut, where a north-south bed was displaced about 40 feet in an east-west direction from one side of the cut to the other, the distance between rock faces being about 60 feet.

Photo 11

Slip folding in acid tuff, Trans-Canada Highway, one mile east of the Provincial boundary.

Alteration, notably silicification and carbonatization, is common in many directions on a small scale in rocks of the area. The dominant direction is nevertheless east-west, and differential weathering has produced outcrop surfaces in which an east-west "bedding" seems obvious. In many places where it is well exposed, the bedding is actually found to be at an angle to this direction of "alteration ridges." Similarly, in the very acid rhyolitic rocks, very closely spaced, east-west slip planes have been channels along which bleaching has taken place. Such fine colour banding is easily mistaken for bedding, but in a few places close examination revealed primary structures at an angle to this direction of bleaching.

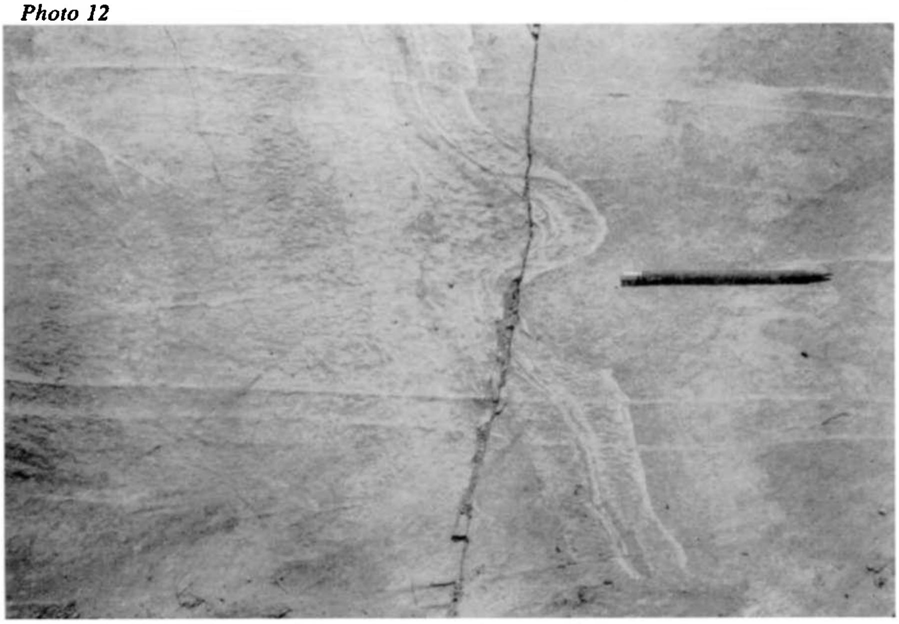
From the discussion above it will be appreciated that poorly exposed outcrops (which probably constitute over 95 percent of all outcrops) normally give impressions of an east-west strike. In most outcrops primary features actually are parallel to the foliation, i.e. within 30 degrees of east-west, but where there

[1]W. C. Brisbin, personal communication.

is the slightest doubt about the primary nature of features the "impressions" must be considered unreliable.

Two other important related features are the elongation of fragments and the distortion of pillows. In both agglomerates and conglomerates an east-west elongation of fragments is evident in almost every outcrop, regardless of the actual strike of the bedding. An example of this in a coarse tuff is shown in Photo 12, where elongation (and slip planes) are parallel to the pencil, whereas bedding is very nearly at right-angles to it. In coarser rocks, notably conglomer-

Photo 12



Elongation of fragments in coarse tuff, Trans-Canada Highway, one mile east of the Provincial boundary.

ates, the elongation seems all the more remarkable. Good examples of this can be seen along the Shoal Lake road near the pond in the south-central part of Ewart township. Bedding, where detectable, is north-south, whereas elongation of boulders up to 2 feet long and 1 foot wide is east-west. The ratio of length to width in a vertical direction is even greater. Simple rotation of boulders is not possible because of the density of boulders in the conglomerate, and it seems likely that elongation is due to slippage on a microscopic scale.

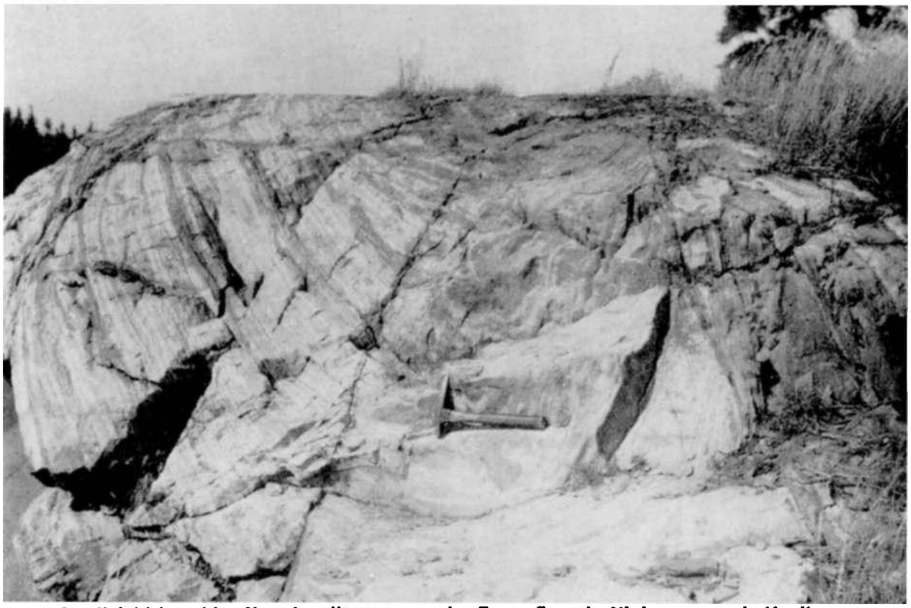
In massive, structureless, basic and intermediate flow rocks there is normally no evidence of distortion. In many places, however, pillows have been obviously distorted such that, for example, pillows with east-west elongation are suspected to have tops to the east. U-shaped pillows are common in some outcrops and must be highly distorted. Very few pillows were considered reliable for determination of tops.

Graded bedding is notably absent in the bedded rocks of the area. It is possible that original grain gradation has been masked by metamorphism.

Folding

As described above, folding and slippage are considered to be intimately related, so that fold axes are also in an east-west direction. It is probable that this direction of folding has been superimposed upon an earlier direction of folding. The hook folds (as interpreted) in Forgie township were originally considered to be the result of the lensing-out of certain beds. Carey (1962, p. 101), however, points out that hook folds are characteristic of strongly folded areas. Earlier fold axes, in the event of two periods of folding, are parallel to the units

Photo 13



Small fold in acid tuff and sedimentary rocks, Trans-Canada Highway, one-half mile east of Shoal Lake road.

"hooked" by the second period of folding. In the present area this would suggest an earlier stage of folding in which fold axes were in a northwest-southeast direction. Carey also outlines some of the extremely complex patterns that are possible in areas characterized by two periods of folding.

The band of conglomerate, arkose, and cherty shale with minor volcanic material, which extends south-southeast through Ewart township and swings east along Crowduck Lake, may represent material deposited in an interfold valley after an early period of folding. If such an interpretation is correct, it would support the theory of early northwest-southeast fold axes. Confirmation of the presence of crossfolds was sought in a study of plunges of minerals, dragfolds, etc., along the Trans-Canada Highway; however, most of the plunges were so steep that the results were inconclusive.

Lack of reliable features for the determination of tops has been the main problem in the structural interpretation of the area. All fold axes shown on the map are placed to conform with the structural interpretation resulting from study of air photographs; in the vicinity of Moth Lake and Chebucto Lake they are

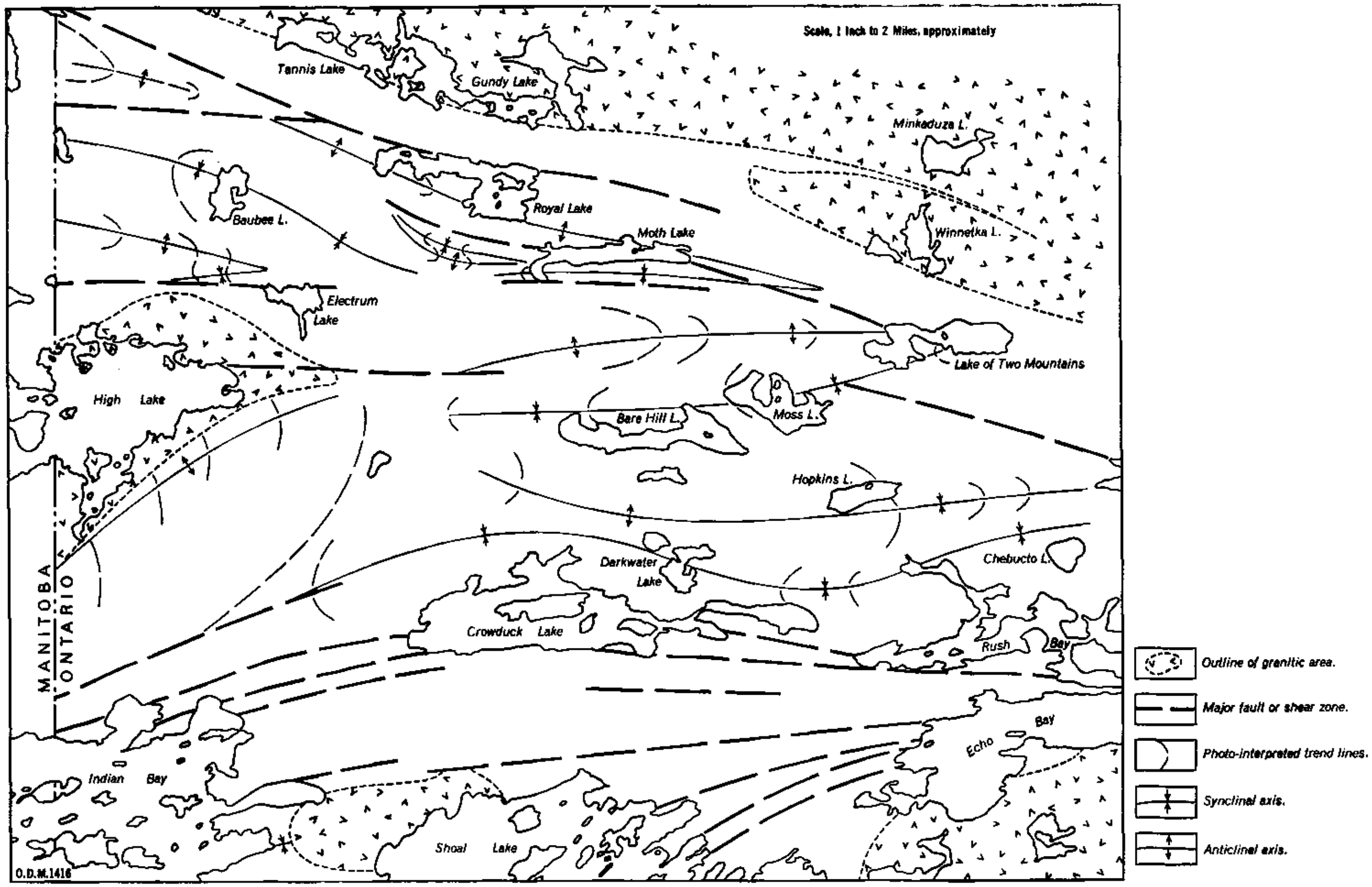


Figure 3 — Essential features of the interpreted structural geology.

almost wholly determined by this method. The author recognizes the dangers of such an interpretation, but believes that the fold pattern shown is essentially correct.

The sedimentary-volcanic sequence in Ewart and Forgie townships is considered to be a wedge between the granitic masses to the north and the prominent linear feature extending through Crowduck Lake and Rush Bay. The pattern is one of folds coalescing and dying out to the east as the wedge narrows. To the east a similar pattern (in reverse) may exist as the wedge widens. It is interesting that the only recognized post-Keewatin sedimentary rocks in the Lake of the Woods area lie within this wedge, i.e., White Partridge Bay (Thomson 1937a, p. 17) and north of Crowduck Lake.

Undoubtedly, faulting and shearing have modified the fold pattern considerably, but the effects have not been measured. It has been convenient in mapping, however, to have folds "disappear" into fault zones in places, but more detailed mapping would be required to verify this. The major syncline found by Greer (1931, pp. 51, 52) in the southern part of Indian Bay was not found to the east, and may be completely masked by faulting.

Faulting

The faults and shear zones shown on the accompanying maps (Nos. 2068, 2069, back pocket) are largely determined by air-photograph study. The field-mapping indicated that fault zones may be extremely narrow, and the adjacent rocks may or may not be schistose. Evidence of faulting, if present, would probably be missed in the course of normal mapping procedures.

Faulting in an east-west direction occurs throughout the area. The influence of this faulting on the outcrop pattern is particularly obvious along the linear depression that extends west from Electrum Lake, and along the zone extending east from the northeast corner of High Lake. Less obvious is the zone through Crowduck Lake and Rush Bay, but it is suggested that this zone of faulting and shearing separates significantly different rock sequences. The lenticular nature of the basic, intermediate, and acid flow rocks and pyroclastic rocks south of the zone is similar to the geology in the vicinity of Baubee Lake, but unlike the andesite-rhyolite sequence north of the zone. The abundant gabbroic dikes and, in the vicinity of Echo Bay, porphyry dikes emphasize the different geology south of the zone. It is possible that the zone dies out to the west, but it can be traced across Lake of the Woods to the east.

Faulting and shearing appear to be primary factors in the control of mineralization in the High Lake area. Minor fractures and shear zones related to the faulting are considered to be more favourable for the deposition of sulphides, particularly where two rock types of different competency are involved.

Linear Features

A statistical study of linear features in Ewart township was undertaken by the field party in 1961. The basis of study was a map prepared in 1961 by Chew-Walker Associates for Bardyke Mines Limited. In making the study, the lengths of linear features as well as their bearings were taken into account. Results of this study, for three parts of the area, are shown in Figure 4.

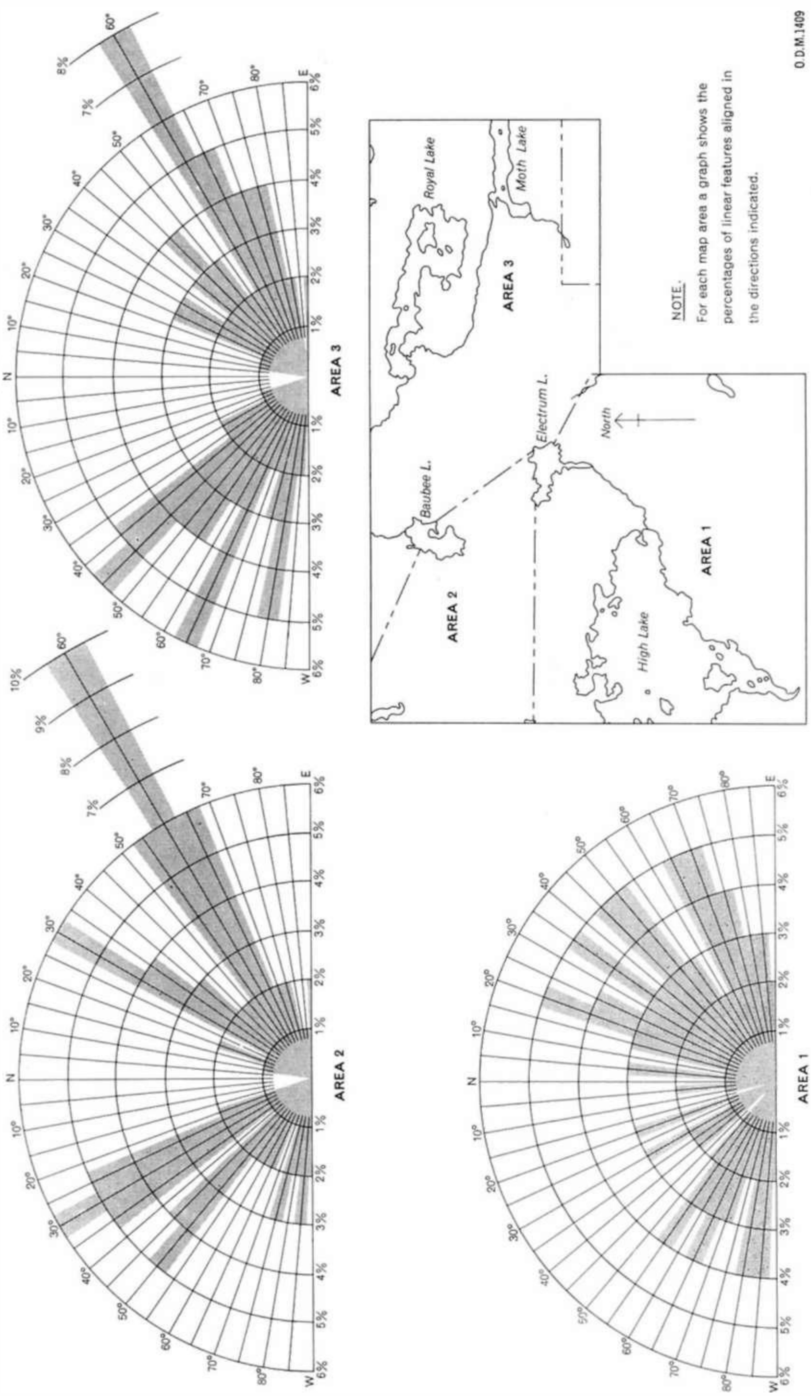


Figure 4 — A statistical study of linear features, part of Ewart township.

A number of observations can be made. First, the predominance of northwest and northeast lineations in the northern part of the township may be due to these directions being complementary shear directions. The compressive force would thus be in a north-south direction and the plane of maximum strain in an east-west direction (all dips being vertical). Secondly, the relative absence of prominent east-west lineations is possibly a reflection of the large amount of small-scale slip in this direction. It should be noted, however, that east-west linear features are the most prominent and most continuous features where they do occur. The dissimilarity of area No. 1 to the other two areas may be significant, especially as all of the important mineral deposits of Ewart township have been found in area No. 1. Area No. 1 is better exposed than the rest of the township, which may account for the greater density of linear features here; but it is suggested that this area has had a more complex structural history than other parts of the township and is thus more favourable for mineralizing solutions.

Though few in number, north-south lineations are prominent in some places, for example, Baubee Lake, Electrum Lake, and south of High Lake. It is probable that these are joints, since north-south jointing is present in many rock outcrops.

Prominent linear features are abundant in the granite areas of Gundy and Broderick townships. Jointing is well developed throughout the granite, and doubtless most of the linear features are joints. An attempt was made to study the jointing by measuring all available structural data at 3,000-foot centres throughout the two townships. In all, about 1,000 measurements of joints were taken and plotted on equal-area nets; however, the work has so far proved fruitless. Additional studies of the data obtained are planned in the Geology Department of the University of Manitoba.

Economic Geology

Although the very early history of the area is vague, it is evident that considerable prospecting took place prior to 1925. A map published by the Ontario Department of Surveys in 1928 shows surveyed mining locations throughout the areas between Crowduck Lake, Shoal Lake, Rush Bay, and Echo Bay; between Moss Lake and Rush Bay; and around High Lake, south to Indian Reserve 39a. Mining locations are also shown south of Bare Hill Lake and south of Gundy Creek.

Since 1935 interest has been almost entirely in the area near High Lake. There has been more surface exploratory diamond-drilling done in a 2-square-mile area at the east end of High Lake than in any area of similar size in the Kenora Mining Division.

Gold, copper, and molybdenum are present in sufficient amounts to justify the numerous exploration programs that have taken place, especially since 1953. Though no large body of ore-grade material has yet been outlined, the area should be given further attention. Some zoning of these metals is evident, and may be a guide for further work.

Description of Properties

In the following description of properties, all information regarding diamond-drilling is filed in the office of the resident geologist, Ontario Department of Mines, Kenora. All assays not qualified by remarks concerning origin are similarly filed in this office. Diamond-drill logs and assays of Electrum Lake Gold Mines Limited were provided by W. P. Mackle; those of Francoeur Mines Limited were provided by C. A. Alcock.

The year in brackets, following the company's name, is the year of ownership, option, or exploration at the time (1962) the report was written.

GOLD

San Antonio Gold Mines Limited (1953)

The first major program of exploration in the map-area was that undertaken in 1953 by San Antonio Gold Mines Limited. It consisted primarily of the geological mapping of part of a large claim group, and the probing of geologically interesting zones by 24 drillholes. At least three zones can be outlined, which received most attention.

Fault Zone

A prominent linear feature extends from High Lake about N.65°E. towards the west end of Electrum Lake. Visible gold found in parallel shears along the north side of this lineation suggested that the linear feature may be a fault zone, which acted as a favourable structure for mineralizing solutions. Five holes were drilled, four under High Lake across the probable extension of the presumed fault zone. In only one hole was evidence of a fault obvious, though in the easternmost hole strongly sheared porphyry was encountered. It would appear that the three western holes did not intersect a fault zone. Mineralization consists of pyrite, pyrrhotite, and chalcopyrite, both in streaks and disseminated through the rock. In the easternmost hole chalcopyrite was not recognized, so that the mineralization is similar to the W and P zones of Electrum Lake Gold Mines Limited. In the definite fault zone the porphyry is stained red, calcite and sericite are common, and mineralization (including minor molybdenite) occurs partly in vuggy fractures. The highest gold assays were 0.04 ounces per ton; the highest copper assays were 0.06 percent.

Contact Zone

The complex zone of volcanic rocks cut by porphyry south and west of the west end of Electrum Lake is here called the contact zone. It includes the A, B, C, and D zones of Electrum Lake Gold Mines Limited, and a number of other shear zones or suspected shear zones, with or without surface showings.

The results of the four holes drilled in C zone and the six drilled in B zone are included in a discussion of the work of Electrum Lake Gold Mines Limited. Two holes were drilled under a shear zone 1,000 feet east of B zone, and though disseminated sulphides were encountered, all gold assays were either trace or nil. A single hole drilled 800 feet north of B zone in carbonatized volcanic rocks encountered only traces of gold and very minor copper. Two drillholes (SA.21 and SA.22, shown in Figure 7), drilled at the south side of a prominent knoll about 1,000 feet south of B zone, investigated a probable buried shear zone. Drillhole SA.22 intersected nothing of significance, but Drillhole SA.21 intersected massive to disseminated chalcopyrite, including a 12.1-foot section averaging 1.04 percent copper and 0.01 ounces of gold per ton.

Camp Zone

A shear zone in carbonatized, epidotized basic lavas about ¼ mile east-northeast of the present camp on High Lake was investigated by four drillholes. Mineralization encountered was similar to that at the surface, i.e., quartz stringers with carbonate, tourmaline, pyrite, and minor chalcopyrite, but the gold content was lower than at the surface. The highest assays obtained in the drill core were 0.04 ounces of gold per ton across about a foot.

Noranda Option

Twelve claims, K.16856–64 and K.16872–74, were examined by Noranda Mines Limited, in 1953. Interest in the area at that time had been aroused by the San Antonio Gold Mines Limited option of a large group to the southwest.

Electromagnetic, magnetometer, and geological surveys were carried out on the claims, but no conductors were found, and slight magnetic anomalies were attributed to changes in rock type. Prospecting failed to uncover any significant mineralization, though very minor sulphides were observed in some rusty-weathering hornblende schists. A few quartz veins were sampled, but nothing of interest was found.

N. A. Timmins (1938) Limited, Group

In 1953, N. A. Timmins (1938) Limited acquired a group of 12 claims between the large group optioned by San Antonio Gold Mines Limited and the Manitoba border. The ground was prospected, and a small number of mineralized zones were uncovered. Most of these were in sheared greenstone and consisted of thin quartz veins containing minor chalcopyrite, molybdenite, and pyrite. The gold content of these zones was very low.

Two pits are located near the shore of High Lake, both in chalcopyrite-molybdenite mineralization. One pit, 7 feet square, attained a depth of 30 feet, and though the mineralization was consistent, the gold assays were only trace to nil. Both pits may have been the work of early prospectors, since Greer (1931, p. 55) records the existence of old workings in this area.

Kenopo Mining and Milling Company Limited (1938)

Electrum Pits

The presence of gold near the south bay of Electrum Lake (also called South Baubee Lake) was first known about 1936. Eight claims, K.8334–41, were staked by C. A. Alcock and R. J. Young of Kenora in March 1937, and optioned to Oliver Severn Gold Mines Limited the same year. In 1938 the claims were part of a group sold to J. A. Poirier; they later became the property of Kenopo Mining and Milling Company Limited, but finally reverted to the ownership of Mr. Poirier.

Electrum is reported in quartz veins within altered quartz porphyry dikes. Arsenopyrite, pyrite, pyrrhotite, chalcopyrite, and tourmaline, and traces of galena and sphalerite, have all been noted in the porphyry. It appears that some mineralization extends slightly into the sheared volcanic wallrocks. The porphyry dikes are 1–5 feet wide, and have a general north-northwest strike, and vertical to steep west dips.

Several pits have been sunk on the mineralized quartz porphyry, and an estimated 250 tons of rock has been removed from the three largest pits. Some of the specimens found are reported to have been spectacular, but the total value of material removed from the pits is not known. At present the bottoms of all the

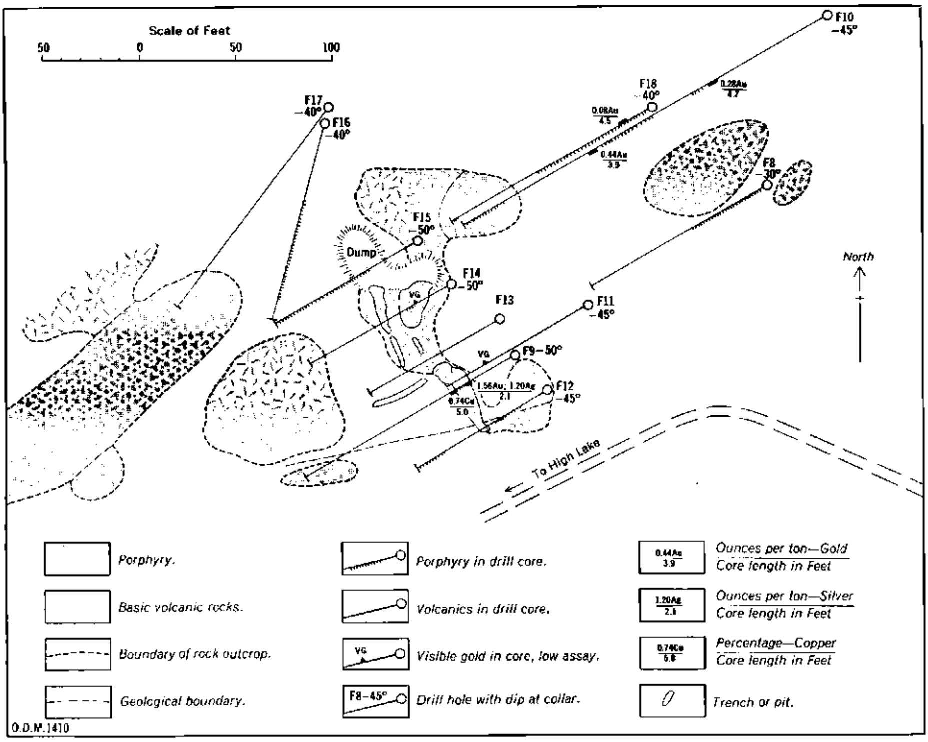


Figure 5 — Geology in the vicinity of the Electrum Pits.

pits are covered, and the wallrocks are more or less barren of mineralization, so the property cannot be properly evaluated. A small arsenopyrite-bearing dike of altered quartz porphyry, at the south end of the northwest pit, was sampled by the author and assayed for gold and silver, but only traces were found. Mr. R. J. Young provided the author with a piece of quartz vein about an inch wide containing very fine, pale-yellow gold (electrum), and he reported that the vein material mined was about the same width.

In 1958, Francoeur Mines Limited optioned the property and drilled 11 holes under or adjacent to the pits. One intersection in a drillhole under the south pit assayed 1.56 ounces of gold per ton and 1.20 ounces of silver per ton over a 2.1-foot core length. The presence of electrum was suspected. One interesting intersection containing copper was found in the same hole, but most of the other drillholes were not encouraging.

Diamond-drillholes, interesting intersections, surface geology, and pits are plotted in Figure 5. The subsurface geology, as determined by drilling, bears little resemblance to the surface geology, and it can be assumed that the porphyry bodies are arranged in a very complex pattern. From the information available at present, the possibility of ore-grade material persisting over any great length or depth seems remote.

Conglomerate Showing

The early history of this property is similar to that given above in the report on the electrum pits, except that the highest-grade section was uncovered in 1937

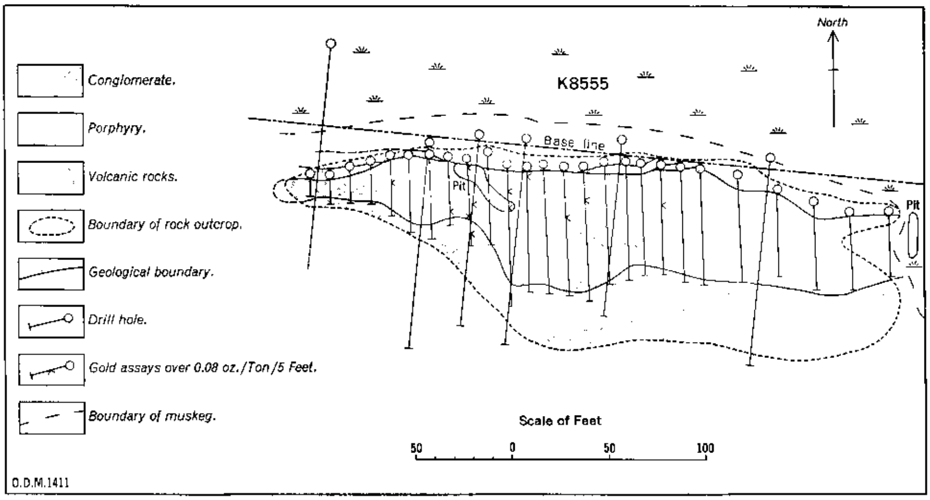


Figure 6 — The conglomerate showing.

by an engineer working for Oliver Severn Gold Mines Limited. The property similarly was transferred to the ownership of Kenopo Mining and Milling Company Limited in December 1938. This latter company operated a small custom mill at Norman, 2 miles west of Kenora, and in 1939 about 76 tons of rock was milled from a showing in the conglomerate on claim K.8555. The average value of gold recovered was $4.87 per ton.

The conglomerate in which the gold was found represents a western extension of the main body of conglomerate present in the vicinity of the Shoal Lake road. The relationships between the conglomerate and the volcanic rocks and porphyry at the showing are not clear, but from relationships found elsewhere the conglomerate is considered to be younger.

The conglomerate fragments are almost entirely of quartz porphyry, and they lie in a dark matrix containing chlorite, epidote, quartz, and carbonate. Most fragments are partly rounded. Pyrite is finely disseminated through most of the rock, and quartz veins with tourmaline and pyrite occur in places. Irregular masses of quartz containing pods of pyrite and some disseminated pyrite occur in the pit from which the bulk sample was taken, and the gold seems to be concentrated here. It is reported that small high-grade pockets were found, which would be confirmed by one rich section encountered by drilling in 1944.

The property was optioned in 1944 to Sylvanite Gold Mines Limited, who carried out an extensive program of channel-sampling and diamond-drilling. The 200 feet of channel-samples gave very low results, the highest assay being 0.04 ounces of gold per ton over 4 feet. The 26 holes totalling 1,526 feet drilled over the exposed length of the conglomerate gave very erratic results; most samples contained only traces of gold, but one (under the north end of the main pit) contained 1.48 ounces of gold per ton across 6 feet. The holes are plotted in Figure 6, together with seven holes drilled in 1958 by Francoeur Mines Limited. It is obvious that the distribution of gold follows no definite pattern, and that significant values are confined to a strike length of 150 feet. One hole drilled by Francoeur Mines Limited tested the possibility of a continuation of mineralization in the quartz porphyry to the west, but results were discouraging.

Claim K.32307

Numerous old trenches are located on surveyed claim K.32307, mainly in sheared basalt. Quartz stringers and pyrite can be found in all of the trenches, the pyrite occurring both as disseminations throughout the altered basalt and as blebs in or adjacent to the quartz. Some silicification is evident in places. In most of the trenches gold can be panned.

The best trench, according to an old assay plan, averaged 0.15 ounces of gold per ton over 24 feet, with one 4-foot section averaging 0.28 ounces per ton. The trench is one of several on an east-northeast-bearing mineralized zone, which extends into claim K.8519. In 1945, Sylvanite Gold Mines Limited, after drilling the conglomerate showing, drilled two drillholes along the eastern extension of the vein. One hole was drilled along the west boundary of K.8519, the other hole was drilled 65 feet to the east. In the west hole the best intersection was 0.02 ounces of gold per ton across 4.5 feet, but one 5-foot intersection in the east hole assayed 0.12 ounces of gold per ton. In 1958, Francoeur Mines Limited drilled four drillholes, three of which cut the main mineralized zone on claim K.32307 (at that time K.17847), but assay results are not available.

Purdex Minerals Limited (1958)

A-D Property

In 1952, J. Duncan and A. Duncan staked 12 claims on and to the southeast of Electrum Lake. These were optioned to Barymin Company Limited, and in 1953 this company geologically mapped the group and did some trenching. The claims were later allowed to revert to the Crown.

Most of the ground was restaked in 1956, and since then has been held jointly by C. A. Alcock and A. Duncan. Eleven claims (K.25128–25134, 26631–26634) were optioned to Purdex Minerals Limited in 1958 after four drillholes drilled by the owners gave encouraging results. By November 1958, over 9,000 feet of drilling had been done on the property, the results of which are discussed below. In 1960 the property was included in a large group of claims optioned to Electrum Lake Gold Mines Limited, but there was no further drilling on the property.

The surface geology of the A-D Property is shown in Figure 7. Some sedimentary rocks are found about 400 feet north of the main showings, but in the mineralized zone the rocks are basic lavas intruded by quartz-feldspar porphyry. The geological contacts shown in areas of overburden are modified projections of diamond-drill intersections.

The main showing consists of two stripped areas, along which there has been some trenching. A complex of quartz veins, most of which trend from within 20 degrees of N.75°W., includes numerous lenses of altered quartz porphyry and volcanic material. Much of the quartz contains tourmaline. Pyrite, ankerite, pyrrhotite, and chalcopyrite are commonly associated with the tourmaline. Gold occurs with the sulphides, and also as fine to coarse, visible grains.

The early drilling by Purdex (Drillholes 1A to 12A) checked the possibility of the zone continuing along the extension of the apparent strike. The two trenches of the main showing reveal that a simple structural picture is improbable for, although they are only about 50 feet apart along "strike", the intervening area is quartz porphyry containing only a few small quartz veins. The west trench trends about N.20°E., the east trench about N.20°W.; and these bearings appear to be the true strike of the mineralized zones, at least over the length of

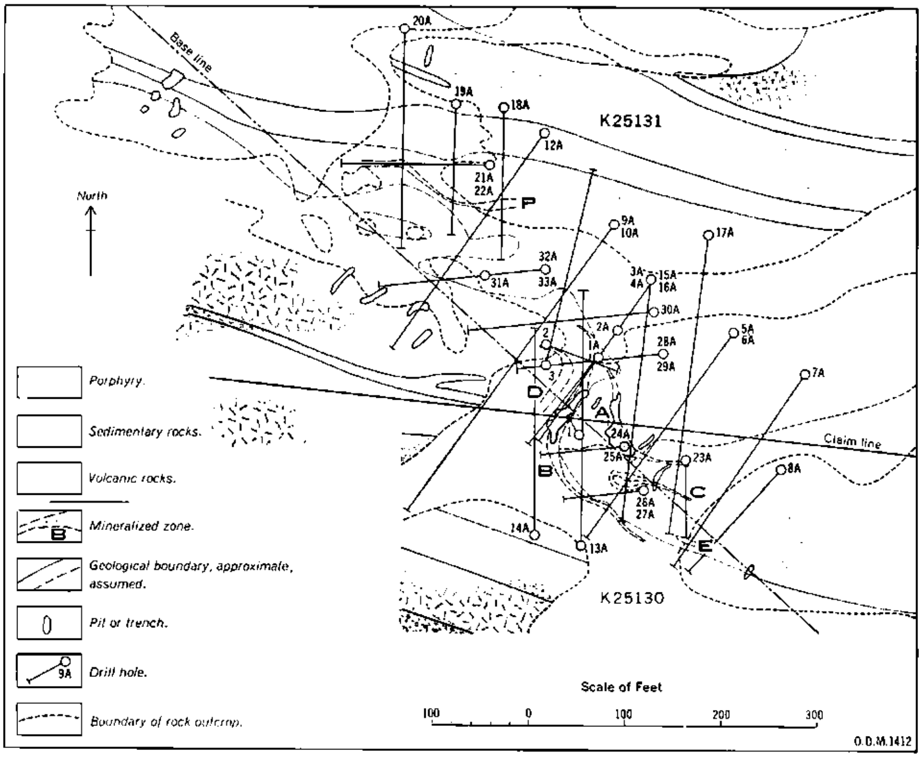


Figure 7 — The A-D Property; Purdex Minerals Limited.

the trenches. The zones are approximately parallel to the adjacent contact between porphyry and volcanic rocks, and the quartz veins within the zones appear to have filled gash fractures. A steep east plunge of the zones is indicated by drilling. Whether the gash fractures are related to simple folding or to a local stress phenomena may have a bearing on the extent of the mineralized zones.

L. K. Lytle, a geologist with Purdex Minerals Limited in 1958, wrote a report in which he evaluates the economic potential of the property. He outlined six zones, all of which are considered related to dragfolds. Five of these zones constitute the main zone, a sixth lies to the northwest and constitutes a second zone. In Figure 7, A, B, C, D, E, and P zones are shown.

Both the A and B zones roughly conform to the contact between the volcanic rocks and porphyry; B zone being at the contact, A zone lying within the porphyry. Both the width of the zones and the gold content increase at the crests of the assumed fold. Extensions to the east are narrow and of low grade, though as Mr. Lytle points out, values and widths would be expected to increase if another "fold" is encountered. Only B zone has been traced west, and it is similarly narrow and of low grade.

C and E zones are surface showings, smaller than A and B zones and not sufficiently explored at depth to determine their possible extent. Both appear to continue to the east.

D zone is not exposed, except possibly to the west in a series of trenches in which gold has been found. The zone is very irregular in shape, conforming to "fold" in both vertical and horizontal planes. Continuation of the zone to the south and east is not known; Mr. Lytle believes that extension of Drillholes 24A and 25A would encounter it, but Drillhole 14A, a hole virtually barren of gold, was not considered in his calculations. The irregular nature of the zone could account for its not being intersected by Drillhole 14A, but without additional information the present author would hesitate to extend D zone beyond the position shown in Figure 7.

P zone is also "folded" in both horizontal and vertical planes with an increase in width and gold values at the crests of folds. It may continue both to the east and west.

The results of the 1958 drilling were summarized by Mr. Lytle and are shown in Table VI.

TABLE VI—RESULTS OF 1958 DRILLING PROGRAM ON A-D PROPERTY, PURDEX MINERALS LIMITED

Zone	Length (To 1958)	Average Width	Depth (in calculations)	Average Gold	Indicated
	feet	feet	feet	oz. per ton	tons
A....	147	4.5	325	0.34	21,400
B..................	160	5.7	215	0.40	19,600
D..................	130	7.7	170	0.30	17,000
P..................	170	4.6	235	0.23	18,500
			Combined	0.32	76,500

The author is very grateful to Mr. Lytle for permission to use the above data.

Electrum Lake Gold Mines Limited (1960)

A substantial program of exploration, including 14,419 feet of diamond-drilling, was carried out on a 44-claim group by Electrum Lake Gold Mines Limited in 1960 and 1961. The company was formed on the 12-claim group originally investigated by Noranda Mines Limited, and it optioned the remainder of the claims from Messrs C. A. Alcock, A. Duncan, and R. Longe, all of Kenora. Financial difficulties in 1961 forced the company to suspend its operations in the area.

At least nine zones were outlined by surface work or magnetometer survey. One of these, the A-D property already described, was not investigated by the company. The other eight are referred to below.

Arsenic Zone

This zone has been so named because, of the nine, it is the only one in which arsenopyrite has been recognized, although the mineral was present in two adjacent holes drilled by San Antonio Gold Mines Limited south of the west end of Electrum Lake. The property was "discovered" by Electrum Lake Gold Mines Limited in 1960, but a very old pit was found on one of the quartz veins.

Surface outcrops occur 900–1,500 feet east of the Shoal Lake road, on the north side of a prominent hill of conglomerate. Irregular masses of quartz containing tourmaline, pyrite, arsenopyrite, and minor pyrrhotite are found in sheared quartz porphyry, and gold is invariably associated with the quartz veins and stringers.

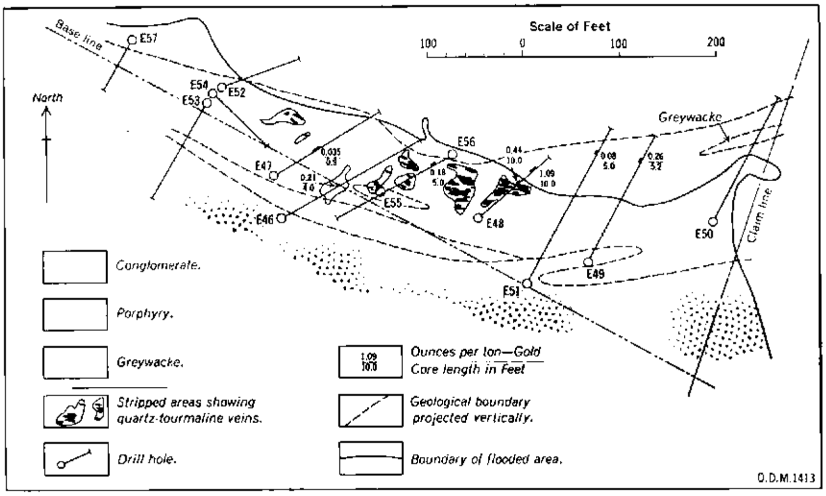


Figure 8 — The Arsenic Zone; Electrum Lake Gold Mines Limited.

The geology of the property is shown in Figure 8. The conglomerate contains rounded pebbles and boulders of granite (much of which is identical to the porphyry) and intermediate to basic volcanic material. There is a decrease in size of the fragments to the north, and the conglomerate appears to grade into greywacke. Garnets and chlorite are present in the conglomerate matrix and in some of the greywacke intersected by drillholes. The sedimentary rocks are sheared, but there appears to have been only limited silicification and carbonatization. Pyrite and pyrrhotite occur as thin seams, but do not contain gold.

The relationship of the porphyry to the sedimentary rocks is not clear. The porphyry is considered to be younger than the greywacke but older than the conglomerate, an interpretation that is not very satisfactory because of apparent gradation between conglomerate and greywacke. Nevertheless, the quartz veins are likely younger than all of the other rocks, even though the gold-bearing quartz veins occur exclusively within the porphyry. Thin quartz stringers in the sedimentary rocks contain at most only traces of gold.

The structural problems are complex. Drillholes E.46, E.47, E.48, E.49, E.51, and E.56 all intersected gold-bearing zones, the best intersections being 0.44 ounces per ton over 10.0 feet and 1.09 ounces per ton over 10 feet, both in Drillhole E.48. If the intersections are directly connected, which they almost certainly are not, a simple average would be 0.31 ounces of gold per ton over a width of 6.4 feet for a length of 350 feet (using the richest intersection in E.48). The drillholes west of E.47 contain negligible arsenopyrite and only traces of gold, so that the western limit of values seems to be defined; if E.47 is eliminated from the average calculations the western limit is better defined, and the grade is increased to 0.36 ounces of gold per ton over a width of 5.8 feet for a length of about 320 feet. The deepest intersection is less than 130 vertical feet.

The eastern extent of the zone has not been determined definitely, in spite of the very low gold assays in E.50 and in the three holes drilled by McIntyre Porcupine Mines Limited to the east. It is possible that the quartz veins occupy a zone of weakness semi-parallel to the interpreted contact of the porphyry with the sedimentary rocks; and although the zone as seen at the surface strikes N.65°W. over a length of 150 feet, it may continue north under the beaver pond. It is anticipated, however, that if such a zone can be defined it will consist of a series of *en échelon* veins elongated parallel to the regional schistosity; it will thus be difficult to assess from surface drilling.

A, B, C, and D Zones

The generalized geology of the volcanic-porphyry contact zone southwest of Electrum Lake is shown in Figure 9. This plan, compiled from maps and drill logs of San Antonio Gold Mines Limited and Electrum Lake Gold Mines Limited, and from surveyor's plans, shows the location of holes drilled by these companies and the more important gold-bearing intersections projected vertically.

The rocks encountered are similar throughout the contact area. Basic lavas, probably all basaltic, have been recrystallized to massive hornblende-rich hornfelses. These in places are veined by carbonate, quartz, and epidote, and in places are sheared. Biotite is abundant in the more schistose phases. Evidence of original pillows can be seen.

The volcanic rocks are intruded by porphyry, dominantly quartz-feldspar porphyry with large pink or white feldspar phenocrysts, but also darker feldspar porphyry. A general shearing from N.45°E. to N.65°E. is pronounced in some places, but scarcely visible in others. Contacts with the volcanic rocks are typically sharp.

Pyrite, pyrrhotite, and chalcopyrite are present throughout the volcanic and intrusive rocks, though concentrations vary considerably. The highest gold assays appear to be in sulphide-bearing schisted basalt, but gold is also found in sheared quartz-feldspar porphyry.

Volcanic areas as outlined can be considered as inclusions in the porphyry, and it must be emphasized that the pattern of occurrence in vertical section is probably as complex as in plan. This introduces difficulties in tracing contacts and mineralized zones, so that limited diamond-drilling will not adequately assess the mineral potential of any zone. One is forced to conclude that a so-called mineralized zone is really a number of mineralized zones which, in the simplest interpretation, will be parallel and *en échelon*.

W. P. Mackle, in a discussion of the problems involved in tracing the mineralization, suggested to the author the possibility that the A, B, and C zones are connected at depth. This would imply a strike of about N.80°W., not N.60°E. as has been generally assumed. Such an interpretation would be consistent with the broad regional structural pattern, and the local pattern of *en échelon* mineralized zones. Furthermore, such an interpretation would greatly enhance the economic possibilities of zones.

A Zone

Surface work on A zone has been minimal. A rusty shear zone at the north contact of the volcanic rocks and porphyry was found, by panning, to contain gold. The first drillhole encountered only traces of gold at the north contact, but near the south contact a 12.1-foot intersection averaged 0.02 ounces per ton gold and 0.24 percent copper. The mineralization is in carbonatized basalt, which contains pyrite and magnetite. Visible gold was noted at one place. The second drillhole, also in altered basalt, averaged 1.94 ounces per ton gold and 2.88 percent copper over 1.5 feet.

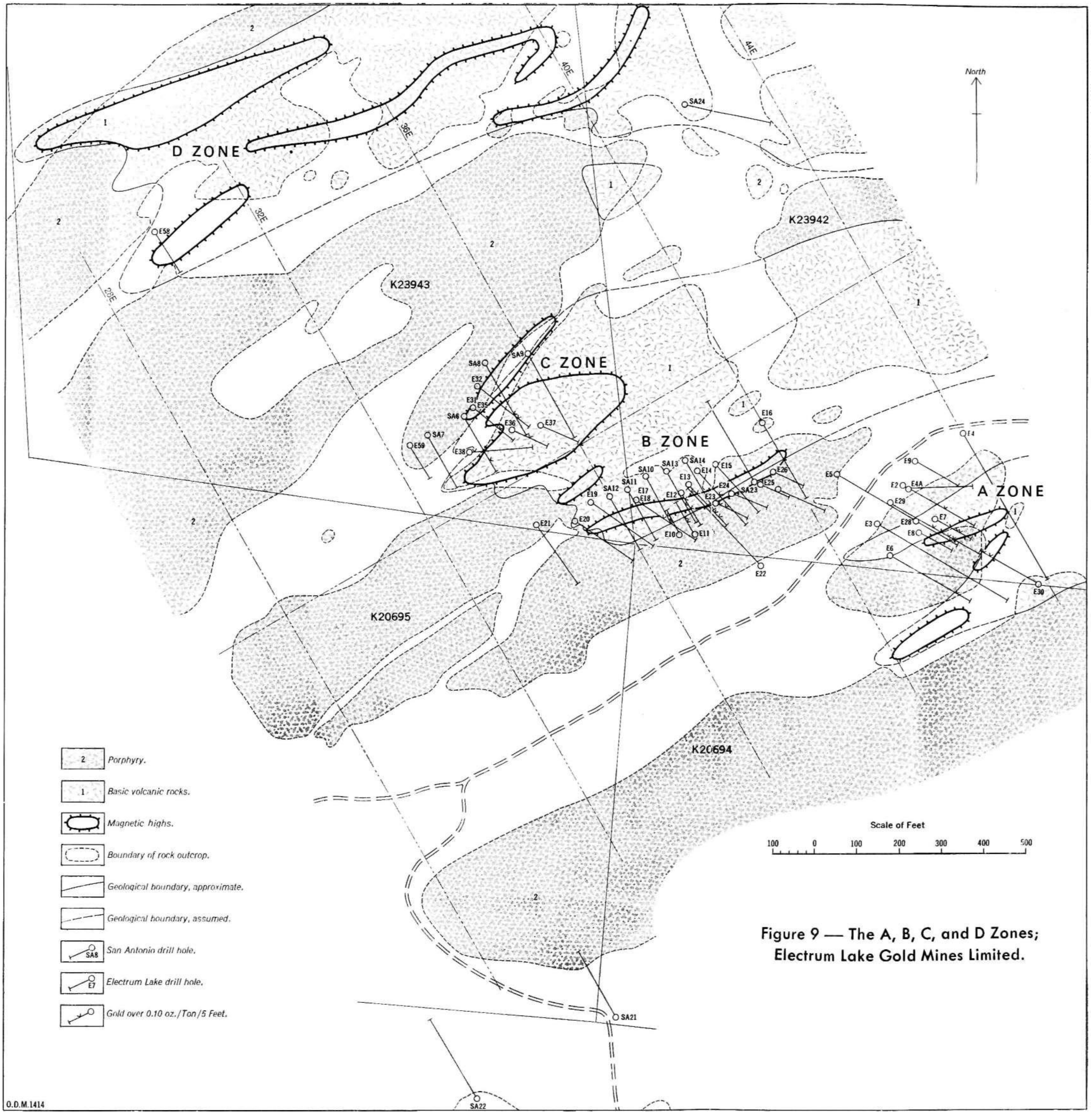


Figure 9 — The A, B, C, and D Zones; Electrum Lake Gold Mines Limited.

Subsequent drillholes were not as encouraging, but of the thirteen holes drilled by Electrum Lake Gold Mines Limited, six contained at least one intersection averaging 0.11 ounces per ton over 5 feet, or better. San Antonio Gold Mines Limited did not drill in the A zone. All of these intersections are in altered basalt, and all contained pyrite and magnetite. Carbonate, quartz, pyrrhotite, and chalcopyrite are also present in some of these intersections.

It may be possible to link the mineralized intersections in Drillholes E.1, E.7, E.28, and E.29. Such a mineralized zone would have a depth of at least 150 feet, an average width of over 5 feet, would average about 0.34 ounces of gold per ton and 0.14 percent copper, but would have a maximum length of less than 100 feet, if it extends parallel to the regional schistosity. It is possible the mineralization parallels the contact (and the magnetic anomalies), in which case only the west end has been delimited for, despite negligible values in Drillhole E.3, both Drillholes E.6 and E.30 intersected 0.27 ounces of gold per ton over average widths of 2.5 and 5.8 feet respectively.

B Zone

A number of trenches have been blasted in steeply north-dipping schistose quartz porphyry, south of the contact with basalt over a length of about 500 feet. Pyrite and minor chalcopyrite occur disseminated through much of the rock and in places contain gold. Some visible gold has been noted in the surface trenches.

The prospect was examined in 1953 by San Antonio Gold Mines Limited, and six holes were drilled at that time. Three of these intersected gold in excess of 0.10 ounces per ton over 5 feet. In 1960, 18 drillholes were drilled by Electrum Lake Gold Mines Limited; half of these intersected at least one zone containing gold in excess of 0.10 ounces per ton over 5 feet. In addition, one hole contained visible gold but assayed lower than the grade given above.

Gold is present in sheared basalt associated with pyrite and chalcopyrite, and in a few places with pyrrhotite and magnetite. In the porphyry gold occurs with pyrite; and quartz, calcite, and chalcopyrite are common associates. Visible gold is found in both basalt and porphyry.

All of the intersections averaging 0.10 ounces per ton over 5 feet are confined to an area 150 feet long and 100 feet wide. The reason for this is not apparent. Connecting individual intersections to one another involves too much guesswork, and it seems probable that mineralization occurs along a number of parallel shears. If intersections in Drillholes E.17, E.18, and SA.10 are connected to intersections in Drillholes E.12, E.13, E.22, and SA.14, a mineralized zone having a length of 150 feet, a depth of 200 feet, and a width of about 3 feet can be envisaged, having an average grade of about 0.27 ounces of gold per ton and about 1 percent copper. Such a zone would be delimited both to the east and west. If, as is probable, the mineralized zones occur in an *en échelon* pattern, the mineralized area may possibly be extended along strike with further exploration.

C Zone

The "nose" of volcanic rocks, surrounded on three sides by granite at the west end of this showing, is represented topographically by a ridge about 40 feet wide and 15 feet high. A trench has been blasted across the entire width of this ridge, exposing steeply north-dipping sheared and massive basalt. Pyrite, chalcopyrite, carbonate, and minor quartz are commonly associated with the sheared basalt, the sulphides occurring both as massive streaks and as disseminations. Gold is found with the sulphides.

San Antonio Gold Mines Limited drilled four holes in the C zone in 1953, two of which cut gold-copper mineralization in sheared and altered basalt. In 1958 at least five holes were drilled in the zone, but little is known about these, and they are not shown in Figure 9. Of the seven holes drilled by Electrum Lake Gold Mines Limited in 1960, six intersected basalt, and five of these intersected gold in excess of 0.10 ounces per ton over 5 feet. A 14.1-foot length of core in Drillhole E.31 averaged 0.44 ounces of gold per ton and 1.55 percent copper. Intersections may be connected in several ways. If a strike of N.60°E. is assumed, a mineralized zone is possible at least 150 feet long, 100 feet deep, and over 5 feet wide, averaging 0.32 ounces of gold per ton and 0.94 percent copper. If the strike is N.40°E., a mineralized zone at least 150 feet long, 150 feet deep, and 4 feet wide is possible, having a grade of 0.25 ounces of gold per ton and 0.63 percent copper. Parallel zones may be drawn in either case. Extension of the zones to the east is possible, but to the west is improbable.

D Zone

Magnetically anomalous areas similar to those over the A, B, and C zones are present in the D zone, and are outlined in Figure 9 as interpreted by Electrum Lake Gold Mines Limited. This company drilled one hole at the west end, intersected 50 feet of altered basalt, but all assays were very low. Plans were made to drill additional holes, but the company was unable to do so.

There is no reason why the D zone should be less favourable economically than the C zone, except that a surface showing has not been found. The rock is not so well exposed as it is to the south. The long narrow anomaly within the basalt does not appear to be a contact effect; the coarser-grained nature of the "basalt" may indicate the presence of a gabbro sill. Pyrite, pyrrhotite, and minor chalcopyrite have been observed in the basalt, and the zone warrants further examination.

P Zone or Porphyry Zone

About 1,000 feet west of the C zone, visible gold has been found associated with sheared quartz-feldspar porphyry. Red iron oxide stain is present throughout most of the rock, giving the rock a red to reddish brown colour. The only significant sulphide present is pyrite, though specks of chalcopyrite have been noted. Where the porphyry is not stained, pyrite is less abundant, and large feldspar crystals are typically white, or partially pink. In the stained porphyry the large feldspar crystals are pink. Gold is clearly associated with the more highly altered porphyry. Thin quartz veins, in places containing tourmaline, are also found more abundantly in the highly altered rock.

Fourteen drillholes tested this zone, which lies on the south side of a prominent hill. Of these holes, only three intersected significant amounts of gold; these three are in the central part of the area drilled. If the intersections are part of a single zone, this zone would be at least 100 feet long, 100 feet deep, and average 11 feet wide, and would contain about 0.40 ounces of gold per ton (assays include visible gold). It is possible that the eleven holes with low gold values failed to intersect the above zone (if a single zone does exist), and an extension of the zone may be encountered, especially to the east.

W Zone or West Zone

One-quarter mile west of P zone the rocks are very similar, but possibly not so intensely altered. Visible gold can be found at the surface in a number of places, especially associated with pyrite-bearing, quartz-tourmaline veins.

Eight holes have been drilled to intersect the downward extension of the steeply northwest-dipping mineralized rocks. Four of the holes may have succeeded in outlining a zone almost 200 feet long, 65 feet deep, about 7 feet wide, averaging 0.23 ounces of gold per ton. The above estimate includes one intersection containing visible gold but assaying very low; exclusion of this intersection reduces the length of the zone to 120 feet but raises the grade to 0.29 ounces per ton. This zone has not been adequately explored either at depth or to the west.

Claim K.23980

In 1960, Electrum Lake Gold Mines Limited drilled six holes over an east-west length of about 900 feet in an area about 500 feet south of the west end of Electrum Lake. It is possible that these holes were located to test a weak magnetic anomaly.

Pyrite, pyrrhotite, and chalcopyrite, with quartz and carbonate in altered basic volcanic rocks, were intersected in each hole; but only in one hole was any notable amount of gold found. This single occurrence was of visible gold associated with pyrite in a thin quartz vein, and is probably not significant. The quartz porphyry dikes that occur in this area are only sparsely mineralized with pyrite, and contain only traces of gold.

Hoey Grubstake (1959) Syndicate

The east boundary of the Electrum Lake Gold Mines Limited group limited the amount of work done by that company on their arsenic zone. After its discovery, the zone was traced across the boundary into the 16-claim group (K.-30450–65) held by Hoey Grubstake (1959) Syndicate. McIntyre Porcupine Mines Limited, Conwest Exploration Company Limited, and Northern Canada Mines Limited participated in the syndicate; McIntyre Porcupine drilled three holes totalling 1,076 feet.

It is apparent from the surface exposures that the veins and the mineralization weaken to the east, and this was verified by the drilling. Assay results were not available but have been regarded as disappointing. The claims were cancelled in 1962.

Selco Exploration Company Limited (1961)

A group of 23 claims lying immediately west of the Electrum Lake Gold Mines Limited group was optioned in 1961 to Selco Exploration Company Limited. The claims extended from High Lake to the pipeline road, and west to within ½ mile of the Manitoba border.

Before the spring ice breakup, four zones were drilled in which gold was known at the surface, but the results of the drilling were discouraging. In one of the zones, about 1,000 feet northeast of the northernmost bay of High Lake, three holes were drilled, and though pyrite, pyrrhotite, and minor chalcopyrite were encountered at depth the gold content was very low.[1]

[1] C. A. Alcock, personal communication.

During the spring and summer, geological and magnetometer surveys were carried out, and the property was prospected. The most interesting of the surface showings is described in the section on copper (*see* p. 73). A number of rusty zones were investigated, but results were not encouraging. Pyrite, pyrrhotite, and chalcopyrite occur within the volcanic rocks adjacent to the porphyry, but the gold content is low. Magnetite has developed with the sulphides in many places, so that this type of mineralization is commonly near a magnetic anomaly.

Additional drilling was not undertaken, and the option was dropped in 1961.

Bardyke Mines Limited (1961)

During the spring of 1961, Bardyke Mines Limited carried out a ground magnetometer survey on a group of nine claims (K.30468, 30469, 30522, 30523, 30524, 30525, 32414, and 32416) on the north side of High Lake at the Manitoba boundary. Much of the ground examined is the same as that prospected by N. A. Timmins (1938) Limited. The survey followed the finding of gold, in association with magnetite, at the Falnora Gold Mines Limited property to the west and the Electrum Lake Gold Mines Limited property to the east, and was successful in outlining two anomalous areas in the central part of the group.

Preliminary sampling of oxidized shear zones in the vicinity of the anomalies revealed some encouraging quantities of gold. Some of these appear to be more closely related to granitic dikes adjacent to a northwest-southeast lineament than to the magnetic anomalies. Recommended stripping of overburden was carried out, but further work was not done.

F. McCallum Group

Four patented claims (K.8844, 8845, 8849, and 8850), owned in 1963 by F. McCallum of Vancouver, are adjacent to the southernmost bay of High Lake. Staked by Mr. McCallum in 1937, one year after a forest fire in the area, neither claims nor showings could be found during the present survey.

According to C. A. Alcock, quartz containing pyrite and gold was found in a northwest-trending shear zone at a point where the four claims meet; also about 0.40 ounces per ton of gold was found across a width of about 4 feet.[1]

Dike Near Shoal Lake Road

An altered, fine-grained acid dike cuts greywacke, 450 feet east of the Shoal Lake road, at a point 1,800 feet south of the pipeline road. The dike is 70–100 feet wide, trends N.40°W., and can be traced for about 500 feet. It appears to be crushed and silicified, with fine pyrite in places. Fluorite was noted in one location where the rock was bleached.

One shallow trench and a few small irregular holes have been blasted in the sulphide-bearing material, but a grab sample taken by the author, of the best-looking rock, assayed no gold. A sample reported to have come from this location, or nearby, contained berthierite ($FeSb_2S_4$), which in turn contained gold, but additional samples of berthierite could not be found.

Gravel Pit, Shoal Lake Road

It was reported to the author in 1961 that rusty gravel and sand, in an old gravel pit immediately east of the Shoal Lake road, contained 0.20 ounces of

[1] Verbal communication.

gold per ton. The area of rusty gravel and sand, which is located about 700 feet north of the pipeline road, is not extensive. A sample taken by the author in 1963 from an area of 2 square feet contained no gold, and it may be assumed that the gold-bearing portions are very local and anomalous.

Gundy Creek

Abundant pyrite and pyrrhotite, associated with silicified sedimentary rocks and quartz veins, are found in a band of greywacke and arkosic greywacke about 2,000 feet south of Gundy Creek. Brief reports on this mineralized zone were made by Parsons (1912, p. 201) and Greer (1931, p. 55). According to Parsons the "pyrrhotite rock is said to contain considerable gold."

A number of pits and shafts were encountered during the present survey. One of these, located on the Manitoba boundary, is at least 30 feet deep, and another, to the east-southeast, is probably over 20 feet deep. Samples of mineralized rock taken from each of these two shafts by the author contained only traces of gold.

Lake of Two Mountains (Page Property)

Quartz veins with minor pyrite are present in schistose sedimentary rocks and acid tuff west of Lake of Two Mountains, on former claim K.9558. The main zone is exposed in two trenches and in one stripped area over a length of about 700 feet, and has an average strike of N.75°E. Sampling of the north-dipping vein system by Sylvanite Gold Mines Limited in 1944 revealed very minor gold, the best in the two trenches being 0.02 ounces of gold per ton over about 5 feet. This property was once known as the Page property.

Shoal Lake

In the area north of Shoal Lake, virtually every pyrite-bearing quartz vein exposed shows evidence of earlier work, testifying to the thoroughness of early prospectors. The veins are mostly small and related to small fractures or tight shear zones. Mineralized material taken from two pits contained only traces of gold.

Golden Horn Mine

The only underground workings and the only gold production in the map-area are on the Rush Bay property (K.12160), once called the Golden Horn mine. The property is easily found by following a very old road from the shore of Rush Bay south for 800 feet.

The property was worked for a number of years from 1901, with a reported total production of $560 (O.D.M. 1941, p. 22). In 1935 the workings were dewatered, and the vein was sampled by Consolidated Mining and Smelting Company.

At present all the buildings are collapsed, and the vein is not exposed at the surface. The property has been described by Thomson (1937a, p. 39), who visited the property at the time of the work by Consolidated Mining and Smelting Company. All of the old workings lie within the boundaries of patented claim K.12160, owned in 1963 by P. Thrasher of Winnipeg.

Island P.549, Rush Bay

Along the northwest shore of Island P.549, Rush Bay, partly in Forgie township and partly in Boys township, the intermediate volcanic flows and agglomerate are highly sheared. Pyrite is found in places along this shear, resulting in a rusty weathered surface. The rusty zone was sampled by E. Chisholm and assayed by the Laboratory Branch, Ontario Department of Mines, but only a trace of gold was found.

A 2-foot quartz-carbonate vein containing very minor pyrite is present on the west side of the island. An assay of 0.01 ounces of gold per ton was obtained from a sample of this rock taken by E. Chisholm and assayed by the Laboratory Branch.

Echo Bay

It is reported by A. Gauthier of Kenora that bornite and gold are present in a 70-foot shaft in the granite several hundred feet south of the southernmost part of Echo Bay. The shaft, begun in 1898 by Great Granite Gold Mining and Development Company of Ontario Limited, was not located in the present survey, but is on old claim No.272E.

Gold is known to exist in a number of places near the eastern part of Echo Bay, outside the present map-area. Several pyrite-bearing, quartz-carbonate veins within the map-area were sampled by the author in 1962, but they contained only traces of gold. One-quarter mile west of Echo Bay a sample, taken by the author, of a silicified rhyolite containing much disseminated pyrite was assayed by the Laboratory Branch and found to contain only 0.02 ounces of gold per ton.

COPPER

Porphyry Copper Zone

In the accounts above of gold properties near High Lake it will be noted that chalcopyrite is very commonly found with the gold-bearing rocks. The B and C zones of Electrum Lake Gold Mines Limited are the best examples of this association. Copper is more rarely found without appreciable associated gold, as for example in Drillhole SA.21 (Figure 7); but, with one exception, persistent copper mineralization of possible economic proportions has not been found.

The single exception is a large area of porphyry, best exposed about 1,500 feet north of the camp at the east end of High Lake. A 75-foot trench, blasted about 1952, revealed disseminated chalcopyrite throughout the granitic rock. According to Thomson *et al.* (1957, p. 14), a channel-sample assayed 0.95 percent copper, and a 150-pound bulk-sample from the trench assayed 1.89 percent copper. Chip-samples taken by the author contained considerably less copper.

A twelve-claim group was optioned to Green Bay Mining and Exploration Company Limited in 1956; six holes totalling 2,155 feet were drilled in the vicinity of the trench. The copper content of sections assayed was 0.10–1.35 percent, but sampling was so spotty as to be of doubtful value in this type of deposit. Some 0.01–0.05 ounces of gold per ton were indicated from sampled sections.

The rock in which the copper mineralization occurs is similar to most of the porphyritic granite in the vicinity of High Lake. It is characterized by bluish grey quartz eyes, 1–3 millimetres in diameter, set in a fine groundmass of buff-coloured quartzo-feldspathic material with large (10–15 mm.) phenocrysts of white or pink feldspar erratically and sparsely distributed throughout. Quartz veins, generally very narrow, cut the porphyry in a number of directions, but are especially abundant in a north-south direction, and possibly represent filled tension fractures. Minor tourmaline, pyrite, chalcopyrite, and molybdenite are found associated with the quartz veins.

Though chalcopyrite, and to the lesser extent pyrite, is disseminated through much of the rock, it is clear that these sulphides are most abundant in zones of weakness. Minute slip planes and adjacent minute fractures are well mineralized; more massive intervening rock is but weakly mineralized. Several distinct shear zones contain massive chalcopyrite and pyrite. An interesting association is that of chalcopyrite and magnetite; the abundance of either of these two minerals in many specimens seems to be directly proportional to the abundance of the other. This association may be a useful tool in prospecting. Minor finely disseminated molybdenite has been found in a number of places.

Photo 14

The original trench in the porphyry copper deposit near High Lake.

Some variation in the quartz porphyry may be attributed to differing degrees of alteration, as on the molybdenum property of Evenlode Gold Mines Limited. A white, generally coarser, phase exposed near the north side of the main outcrop area contains some fluorite, suggesting the difference in appearance may be essentially a difference in degree of bleaching. Surface leaching to a depth of about ¼ inch makes recognition of the mineralized zone very difficult, if not impossible, without blasting.

Work done during 1963 successfully extended the known area of copper mineralization to a length of at least 2,000 feet and a width of about 250 feet. Only on the south side was the deposit delimited. To the northeast, north, and northwest there are muskegs. In October 1963 blasting uncovered similar mineralization in porphyry outcrops to the west. The south side coincides with a marked east-west linear feature, very evident on air photographs but rather obscure on the ground. It is suggested that this fault may be one of the features controlling copper (and gold) mineralization in the area.

The grade of deposit is not known because a dependable sampling program has never been undertaken. The author believes that the over-all grade is probably about 0.25–0.5 percent copper, but actual evaluation must await extensive sampling. If the ratio of copper in the channel-sample to copper in the bulk sample as reported by Thomson *et al.* is a guide, then the actual grade of the deposit may be about twice as high as the author's estimate. The deposit is large and certainly warrants further work.

Selco Exploration Company Limited (1961)

The work done on the group of claims obtained by Selco Exploration Company Limited in 1961 revealed that very minor chalcopyrite, and to a lesser extent molybdenite, is present throughout much of the porphyry in the area near the north shore of High Lake. This is particularly significant in view of the low-grade copper deposit described above, which occurs about a mile to the east. One zone, in which copper mineralization is more concentrated, was uncovered by Selco prospectors about 900 feet north of the lake, in the eastern part of claim K.29004.

In this showing, thin massive veins of pyrite and pyrrhotite occur in fractures in the porphyry. Six pits have been sunk on the zone, the easternmost of these lies at the edge of low ground. Chalcopyrite and minor bornite are found with the massive iron sulphides and as disseminations in the adjacent porphyry. The average width of the mineralized zone is about 6 feet, the strike is about N.70°E., and the dips are steeply south. In one assay, 0.03 ounces of gold per ton and 0.4 ounces of silver per ton were reported, in addition to copper in excess of 1 percent. The zone has been traced for about 300 feet, and it is associated with a magnetic anomaly 500 feet long. The showing has not been drilled.

Crowduck Lake

A group of six claims (K.16688–16693) was staked in 1952 south of the second largest island in Crowduck Lake. Some work was done on a showing lying approximately on the township line, about 800 feet southeast of a sand beach.

A shear zone, 6 feet wide in places, forms a steep cliff face and marks the north contact of the gabbro in the western part of the property. To the east, andesite and minor rhyolite are the dominant rocks. Silicification and carbonatization is evident along the steeply north-dipping shear zone. Thin quartz veins containing minor blebs of pyrite and chalcopyrite are common in parts of the sheared rock.

The property is not considered important, but the presence of copper along this major zone of shearing and gabbro emplacement is interesting.

ZINC, COPPER, SILVER

Claim K.28595

An interesting exposure of sulphides in sheared basalt occurs at the south side of a large outcrop area, about a mile due east of the east end of High Lake. Pyrite, chalcopyrite, sphalerite, pyrrhotite, and galena, well exposed in a 7- by 20-foot pit, are associated with the most highly sheared portion of the basalt. Grab samples can be taken that contain up to 3 percent zinc, 1 percent copper, 0.25 percent cobalt, 0.08 ounces gold per ton, and 3 ounces silver per ton.[1] Width of the best mineralized zone is about 4 feet.

The east-west-striking sinuous shear could not be found 30 feet east of the main pit, and it is narrow and difficult to locate 20 feet west of the main pit. On the surface it appears to be a small, very local structure. A slight magnetic anomaly does exist to the north and is possibly associated with a coarser phase of the basalt.

The property was optioned in 1962 by Chimo Gold Mines Limited. This company carried out an electromagnetic induction survey and drilled one 503-foot hole from the south, but they were not successful in locating an extension of the mineralized zone, and the option was dropped the same year.

Baubee Lake

Claims lying west and northwest of Baubee Lake have been staked a number of times by Finley McCallum of Winnipeg. Stripping and trenching, recorded for assessment purposes with the Department of Mines, were not found during the present survey.

Thomson *et al.* (1957, p. 19) report lead, zinc, copper, and silver occurrences on the property. The finely disseminated sulphides seen in rock cuts along the highway are mentioned as containing "some values in nickel and cobalt," but but do not appear important. They also report that a geophysical survey was conducted, and 4,500 feet of drilling was done, but these were not recorded for assessment purposes.

The area is one in which acid, intermediate, and basic lavas and tuffs predominate; though gabbro has been noted in a number of places.

MOLYBDENUM

Evenlode Mines Limited

The initial discovery of mineralization at the east end of High Lake was made by C. A. Alcock in 1937. This consisted of molybdenite and minor chalcopyrite and pyrite associated with quartz veins in sheared granite. In 1938, two other molybdenite-bearing vein systems were found south and southwest of the original discovery, but these were lower in grade. The three zones are referred to in this report as the main vein, No. 2 vein, and No. 3 vein, respectively, and are shown in Figure 10.

Prior to 1940 two trenches were blasted along the main vein; exposing about half of the traced length of 200 feet. Sampling along these trenches indicated a grade of about 1 percent molybdenite across 3 feet.

In 1942, Wartime Metals Corporation, a Federal Government agency, drilled the property and extended the known length to over 400 feet. It is reported by Brown (1962) that 21 holes, totalling 3,688 feet, were drilled, and that the grade across a core intersection averaging 3.7 feet was 0.97 percent molybdenite.

In 1959 three patented claims (K.8705–8707) were optioned by Evenlode Mines Limited. The main vein and No. 3 vein are on the eastern two of these claims. In 1960 fourteen unpatented claims (K.28936, 28937, 29277–29284, and 30427–30430) were optioned, No. 2 vein being on one of these.

Exploration from 6 February 1960 to 31 December 1962 included geological surveys, bulk-sampling, and the drilling of 61 holes totalling 15,797 feet. A

[1] C. A. Alcock, personal communication.

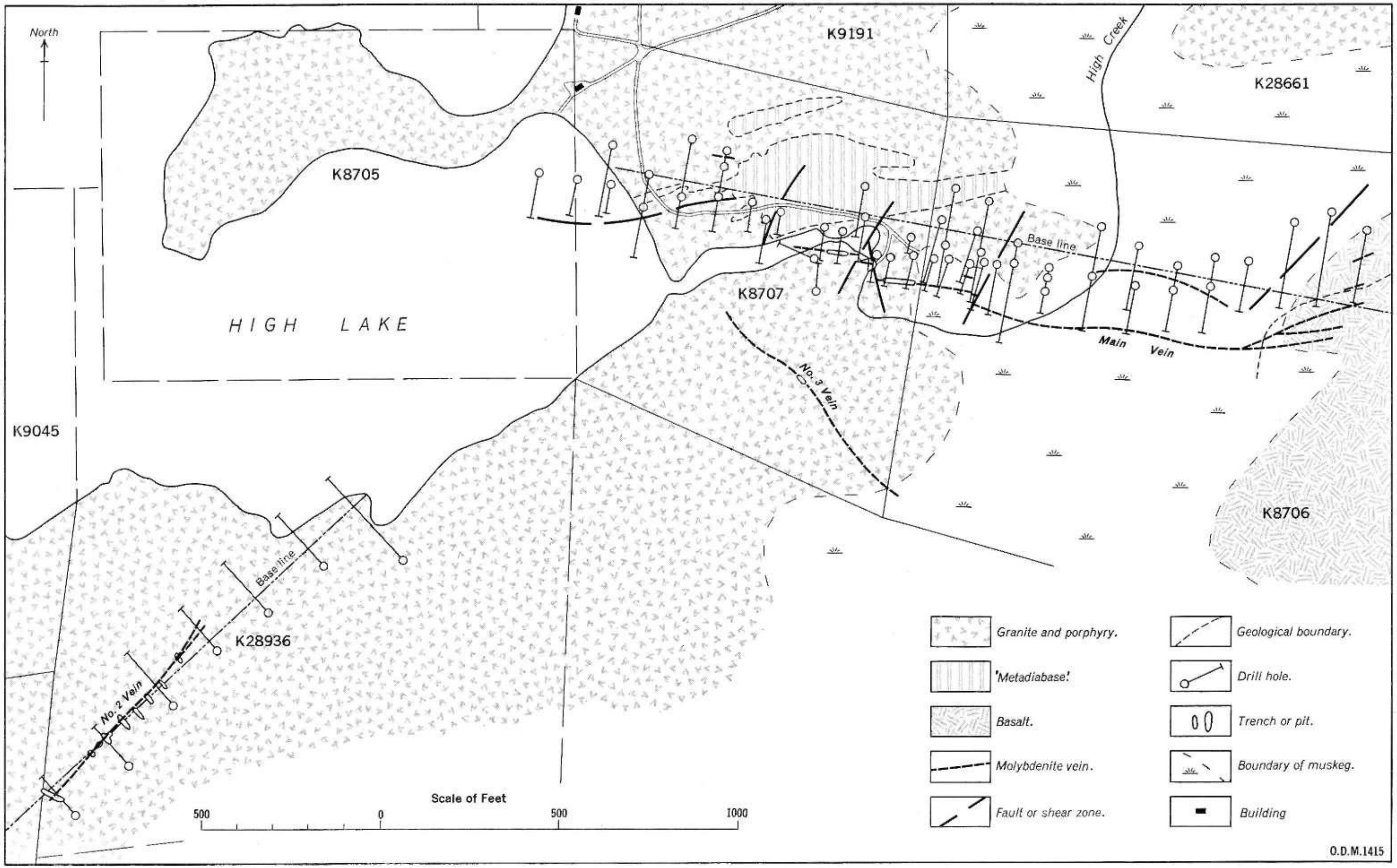


Figure 10 — Evenlode Mines Limited.

number of holes were drilled during 1962, but the results are not filed with the Ontario Department of Mines. In the following discussion, all statistics relating to dimensions and grade are taken from the report of Mr. Brown, as also are some of the geological details.

The host rock of all three veins is believed to be the youngest phase of a granitic complex that underlies most of High Lake and immediately adjacent areas. Inclusions of volcanic rocks and of the earlier granitic phases are present in the host rock. Some alteration is present in all of the rocks, but it is more pronounced in the vicinity of shear zones.

The main vein is associated with a strong shear zone striking about N.80°W. and dipping about 80°N. in its central portion, but more shallow to the east and west. Obliteration of feldspar phenocrysts, development of sericite, and minor silicification occur adjacent to the shear zone, in which quartz veins, lenses, and stringers are found. The shear zone has been traced for about 2,300 feet, the eastern 1,600 feet being that portion containing mineralized quartz. A body of basic rock, considered to be intrusive metadiabase by Evenlode officials, appears to have been instrumental in confining mineralization to the eastern portion.

A bulk-sample taken across 3½ feet from the trenches on the main vein averaged 0.89 percent molybdenite and 0.015 ounces of gold per ton. It is reported that the average molybdenite content of drillholes under the same section is about 29 percent lower, indicating that grade as determined by drilling is lower than actual grade. "Drill indicated ore" over a length of about 1,200 feet (east from the west trench), across an average width of 4.7 feet, and to an average vertical depth of 508 feet, has been calculated at about 126,000 tons grading 0.68 percent molybdenite (Brown 1962).

The No. 2 vein system consists of one dominant and several parallel subsidiary veins, ranging from 1 to 4 feet in width, in sheared porphyritic granite. Prior to optioning by Evenlode Mines Limited, a number of trenches had tested the vein system, but it had never been drilled. In 1960 and 1961 seven holes, totalling 2,064 feet, were drilled over a strike length of about 1,200 feet One hole did not encounter any mineralized vein. The mineral potential of the No. 2 vein system is difficult to evaluate, partly because of its width (veins occur across 30–80 feet), and partly because more information is desirable. The dominant vein in the southwestern part has been traced for 700 feet, and is reported to average 0.47 percent molybdenite over a 2.2-foot width, with gold averaging 0.02–0.05 ounces per ton. The No. 2 vein system may extend farther to the northeast under High Lake, and to the southwest on to patented claim K.9046.

The No. 3 vein occurs in porphyry, which appears to be less altered than that at the main vein and No. 2 veins. The vein strikes about northwest and dips 45°–80°NE. Seven pits were sunk on the vein prior to 1942 revealing a vein width of 10–22 inches. The grade has been estimated at about 1–2 percent molybdenite.

Several other veins exist, notably north of the main vein. The longest of these has been traced for 550 feet but is very low in grade. Further work would be required before any of these veins could be evaluated.

In addition to the 126,000 tons of "drill indicated ore" outlined in the main vein, "possible ore" has been calculated at about 625,000 tons. The" possible ore" is mostly derived from the main vein up to a vertical depth of 800 feet, but also includes about 100,000 tons derived from other veins on the property (Brown 1962).

Claim K.32306

Molybdenite occurs in a number of places just north of the east end of High Lake, mainly associated with pyrite- and chalcopyrite-bearing quartz veins, but also in sheared quartz porphyry. The most interesting of these molybdenite-bearing zones was drilled early in 1963 by C. A. Alcock. Each of two holes intersected a number of molybdenite-bearing zones. Assays of the best intersections are reported to average 0.28 percent molybdenite across 12 feet in the east holes, and 0.34 percent molybdenite across 6 feet in the west hole. Above the east hole a 22-foot trench containing molybdenite and very minor chalcopyrite is said to have averaged about 0.07 ounces of gold per ton over the entire length.[1]

Gundy Lake

In 1962 four claims were staked along the contact of granite with sedimentary rocks in the area south and east of the east end of Gundy Lake, Forgie township. Molybdenite is present associated with quartz veins and stringers, and in minute fractures and along schistosity planes in the country rock, and it is reported to have been found adjacent to the contact in numerous places over a strike length of about 2 miles.

Very minor stripping has been done. Assays of chip-samples taken by the author vary considerably, but appear to be about 0.10–0.30 percent molybdenite across 6–10 feet. Powellite is present as a filmy alteration product in some places, and a few specks of scheelite have been identified. More work will be necessary to evaluate this property.

IRON

Iron formation, using the term in its strictest sense, does not occur in the area. South of Lake of Two Mountains, and near the provincial boundary at West Hawk Lake, very fine-grained magnetite has developed during the metamorphism of dark, fine-grained sedimentary rocks (possibly tuff in part). The magnetite content probably does not exceed 15 percent, and the rocks have no potential value as a source of iron.

A piece of float about 3 inches in diameter, found by the author's senior assistant, J. Hodgkinson, about a mile northwest of Crowduck Lake, was found to be composed almost entirely of iron carbonate and hydrous iron oxides. Alteration zones in volcanic rocks north of this location were noted to be similar mineralogically, and probably they were the source of the float. Iron carbonate is present also as a boulder in conglomerate east of the pond in the south-central part of Ewart township.

SAND AND GRAVEL

Glacial deposits of sand and gravel occur throughout the map-area, commonly on the southwest sides of rock outcrops. These deposits are mostly small, very poorly sorted, and of doubtful potential value. A number of broader areas considered to be glacial outwash plains do occur, mainly in Ewart and Forgie townships, and are shown on the glacial map (Figure 2).

Investigations made by Ontario Department of Highways in 1962 indicate that about 200,000 cubic yards of material remain in four pits adjacent to highway No. 17 in the vicinity of Lake of Two Mountains. Of this amount, about three-quarters is sand and the remainder crushable material. It is estimated that

[1] C. A. Alcock, personal communication.

over 200,000 cubic yards of sand and gravel has already been removed from pits in Forgie township, and about half of this has come from the above four pits.

Considerable undeveloped resources remain in both Ewart and Forgie townships; those in Ewart township may not be developed for many years because of their greater distance from the highway.

STONE

Quarrying of building stone has never been undertaken in the area. Near the northwest end of Macara Lake uniform pink granite with subhorizontal jointing was noted, and it is possible that similar rock exists closer to the railway track.

The cherty rhyolite on the Shoal Lake road northwest of Crowduck Lake has been considered as possible aggregate in polished building blocks. Numerous sericitized slip planes within the rhyolite may however make the rock unsuitable for such blocks.

Suggestions for Future Mineral Exploration in the Area

The more important mineralized zones within the map-area appear to be confined to a small area around High Lake. A possible explanation for this is given in the section of the report on structural geology, in which it is suggested that the area near High Lake has had a more complex structural history. The features that appear to be the most important factors in the control of mineralization are shearing or faulting, and the contact of two rock types of markedly different competency. Shearing and faulting are abundant throughout the map-area, but only near High Lake is there such a complexity of two different rock types.

North and east of High Lake, prospecting should continue in the vicinity of basalt-porphyry contacts. Minor shear zones adjacent to prominent linear valleys are potentially favourable for mineralizing solutions. The association of gold-bearing and copper-bearing zones with magnetic anomalies has been demonstrated, and the use of a magnetometer in all ground work throughout the area may prove effective.

The area around and west of Echo Bay appears to be favourable for prospecting. Acid volcanic rocks, porphyry dikes, quartz-carbonate veins, silicification, and pyrite mineralization are abundant, however, the work to date indicates that gold occurs only in negligible quantities. The possibility of copper and perhaps nickel in the vicinity of the gabbroic dikes should not be discounted.

Contacts of acid and intermediate volcanic rocks in Forgie township may be favourable for mineralizing solutions, particularly at the noses of folds where shearing is more sharply defined. During the present survey very little mineralization was noted in these areas, but thorough prospecting would be necessary to adequately assess the possibilities.

The entire length of the contact, between the volcanic-sedimentary sequence and the large mass of gneissic granodiorite to the north, is of some interest. The low gold content of the sulphide-bearing rocks found to date has not been encouraging, but the presence of molybdenite in numerous places along the contact southeast of Gundy Lake indicates that this zone has been favourable for mineralizing solutions.

Bibliography

Brown, B. B.
1962: Report on Evenlode Mines Limited, Ewart township, Ontario; included in the Company Prospectus for 1962.

Carey, S. W.
1962: Folding; Journal of Alberta Society of Petroleum Geol., Vol. 10, No. 3, pp. 95–144.

Davies, J. F.
1954: Geology of the West Hawk Lake–Falcon Lake area; Manitoba Mines Branch, Publication No. 53-4.

Goldich, S. S.; Nier, A. O.; Baadsgaard, H.; Hoffman, J. H.; Krueger, H. W.
1961: Precambrian geology and geochronology of Minnesota; Geol. Surv. Minnesota, Bull. 41.

Greer, Leonard
1931: Geology of the Shoal Lake (west) area, District of Kenora; Ontario Dept. Mines, Vol. XXXIX, pt. 3, pp. 42–56.

Lawson, A. C.
1885: Report on the geology of the Lake of the Woods region; Geol. Surv. Canada, Vol. I, pt. CC.

Lytle, L. K.
1959: Report on Electrum Lake gold property; private report. (Copy filed in the resident geologist's office, Kenora.)

O.D.M. (Report)
1941: Statistical review of the mineral industry of Ontario for 1939; Ontario Dept. Mines, Vol. XLIX, 1940, pt. 1, p. 22.

Parsons, A. L.
1911: Gold fields of Lake of the Woods, Manitou and Dryden; Ontario Bur. Mines, Vol. XX, pt. 1, pp. 158–78.
1912: Gold fields of Lake of the Woods, Manitou and Dryden; Ontario Bur. Mines, Vol. XXI, pt. 1, pp. 198–203.

Springer, G. D.
1952: Geology of Rennie–West Hawk Lake area; Manitoba Mines Branch, Publication No. 50-6.

Thomson, Jas. E.
1937a: Geology of the north central part of the Lake of the Woods, Ontario Dept. Mines, Vol. XLV, 1936, pt. 3, pp. 1–43.
1937b: Gold deposits on Shoal Lake (west); Ontario Dept. Mines, Vol. XLV, 1936, pt. 3, pp. 44–53.

Thomson, Jas. E.; Ferguson, S. A.; Johnston, W. G. Q.; Pye, E. G.; Savage, W. S.; Thomson, Robert
1957: Copper, nickel, lead, and zinc deposits in Ontario; Ontario Dept. Mines, Metal Resources Circ. No. 2.

Turner, F. J. and Verhoogen, John
1960: Igneous and metamorphic petrology (second edition); McGraw-Hill Book Co. Inc., New York, U.S.A.

Zoltai, S. C.
1961: Glacial history of part of northwestern Ontario; Proceedings of Geol. Assoc. of Canada, Vol. 13, pp. 61–83.

INDEX

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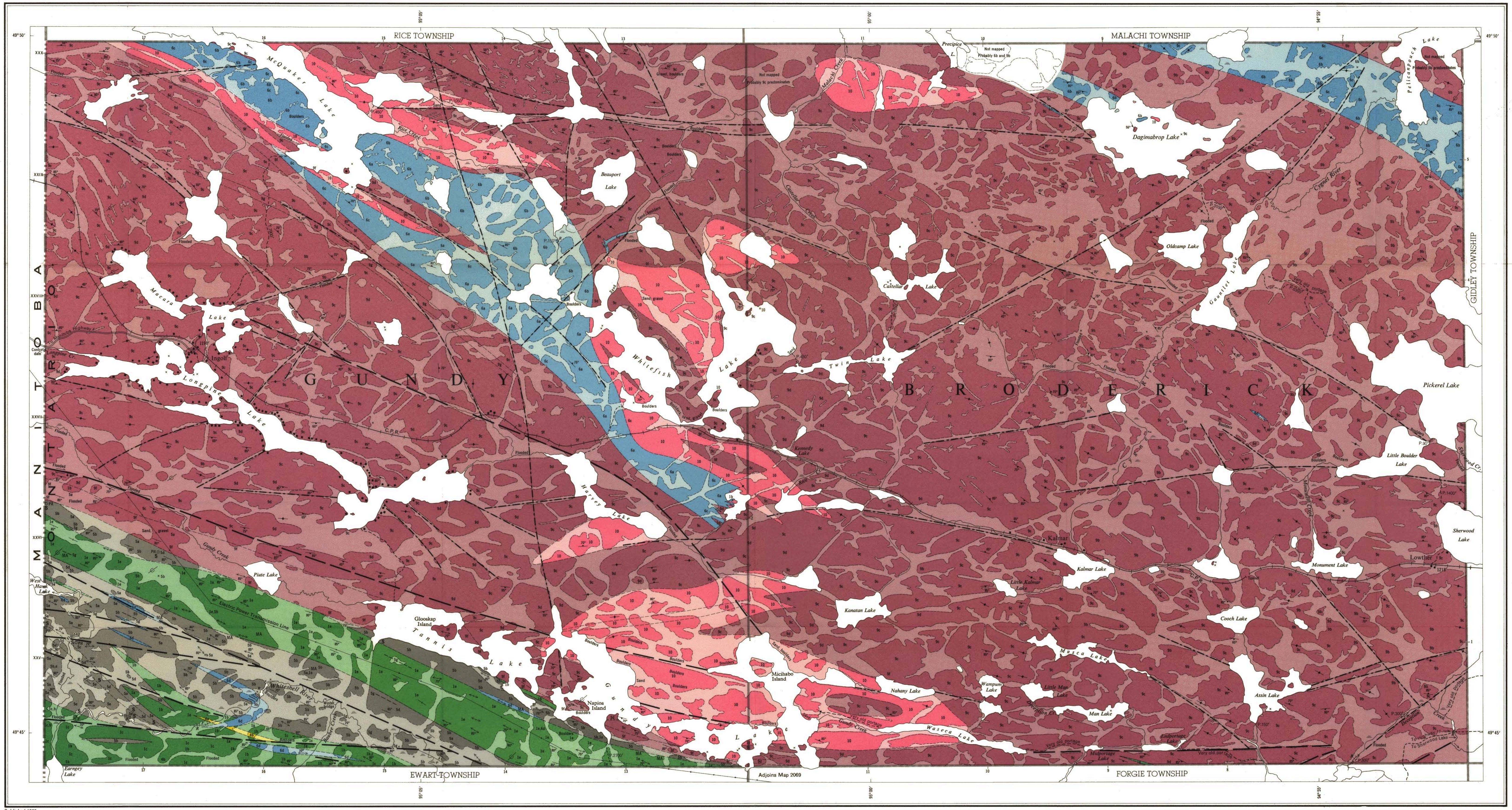
ONTARIO
DEPARTMENT OF MINES
HON. G. C. WARDROPE, *Minister of Mines*
D. P. Douglass, *Deputy Minister*   M. E. Hurst, *Director, Geological Branch*



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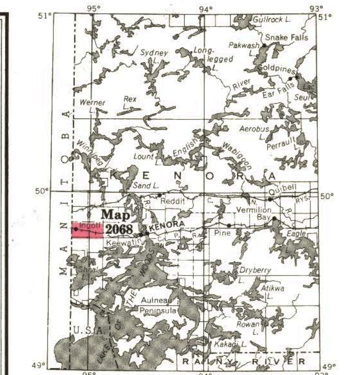

Scale 1 inch to 50 miles

N.T.S. reference 52 E/10, 52 E/11, 52 E/14, 52 E/15

LEGEND

CENOZOIC*

RECENT

Lake, stream and swamp deposits.

PLEISTOCENE

Sand, gravel, clay.

GREAT UNCONFORMITY

PRECAMBRIAN**

PROTEROZOIC

11 — *11 Diabase.*

INTRUSIVE CONTACT

ARCHEAN

LATER ACID INTRUSIVE ROCKS

10 — *10 Pink quartz monzonite and granodiorite, with some grey foliated granodiorite.*

INTRUSIVE CONTACT

9 —
9a Quartz monzonite.
9b Grey granodiorite.
9c Gneissic hornblende-biotite granodiorite, with aplite, pegmatite, and dark inclusions.
9d Grey granodiorite with much pink granodiorite.
9e Tonalite and diorite.
9f Border phase of hybrid rocks and lit-par-lit gneiss.
9g Granodiorite with large feldspar "eyes."

INTRUSIVE CONTACT***

CROWDUCK LAKE GROUP

8 —
8a Argillite and cherty argillite.
8b Arkose, arkosic greywacke, impure sandstone, (tuff?).
8c Conglomerate.
8d Reworked agglomerate.
8e Volcanic rocks.

UNCONFORMITY

EARLIER ACID INTRUSIVE ROCKS

7 —
7 Porphyritic intrusive rocks.
7a Porphyritic granodiorite.
7b Quartz porphyry.
7c Feldspar porphyry.

INTRUSIVE CONTACT

BASIC INTRUSIVE ROCKS

6 —
6a Quartz-hornblende diorite.
6b Hornblende diorite.
6c Diorite with much injected granodiorite.
6d Gabbro.

INTRUSIVE CONTACT

KEEWATIN GROUP****

METASEDIMENTS

5 —
5a Arkose.
5b Greywacke, arkosic greywacke, (tuff).
5c Conglomerate, reworked agglomerate.
5d Iron-rich greywacke.
5e Slate, Iron-rich slate.
5f Siliceous siltstone, cherty sediments, (tuff).
5g Garnet-rich greywacke.

ACID VOLCANIC ROCKS

4 —
4a Bedded rhyolitic and dacitic tuff, minor flows and agglomerate.
4b Massive fine-grained rhyolitic and dacitic tuff.

3 —
3a Porphyritic (quartz) rhyolite flows with minor tuff, agglomerate, and quartz porphyry dikes.
3b Rhyolitic agglomerate.

INTERMEDIATE VOLCANIC ROCKS

2 —
2 Intermediate and acid extrusive rocks.
2a Andesite.
2b Porphyritic andesite.
2c Andesite-dacite agglomerate.
2d Andesite-dacite tuff, agglomerate and flows.

BASIC VOLCANIC ROCKS

1 —
1 Basic and intermediate extrusive rocks.
1a Andesite.
1b Basalt.
1c Tuff, lapilli tuff.
1d Agglomerate and tuff.
1e Interbanded lensy tuff, flows and sediments.
1f Hornblende-biotite-plagioclase schist.
1g Gabbro, coarse-grained tuff and flows (possibly gabbro).
1h Pillow lava.

S — *Sulphide mineralization.*

**Unconsolidated deposits. In general, Cenozoic deposits are represented by the lighter coloured parts of the map.*

***Bedrock geology. Outcrops and inferred extensions of each rock map unit are shown respectively in deep and light tones of the same colour. Where in places a formation is too narrow to show colour and must be represented in black, a short black bar appears in the appropriate block.*

****This intrusive contact is inferred only, and some of the Later Acid Intrusive Rocks may actually be older than the Crowduck Lake Group.*

*****Basic, Intermediate and Acid Volcanic Rocks and Metasediments are interbanded, so that the order given does not imply age relationships.*

Formations without colour in the legend blocks are mapped on the companion sheet.

Map 2068

GUNDY AND BRODERICK TOWNSHIPS

KENORA DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

Chains 80 60 40 20 0 1 2 Miles

Metres 1000 0 1 2 3 Kilometres

Feet 1000 0 5,000 10,000 Feet

SYMBOLS

Glacial striae.
Small rock outcrop.
Boundary of rock outcrop.
Geological boundary.
45° — *Strike and dip; direction of top unknown.*
Strike and vertical dip; direction of top unknown.
Anticlinal axis.
65° — *Strike and dip of schistosity.*
Strike of vertical schistosity.
75° — *Strike and dip of gneissosity.*
Strike of vertical gneissosity.
55° — *Jointing, inclined.*
Fault, indicated or assumed.
80° — *Fault, defined; spot indicates downthrow side; arrows indicate horizontal movement.*
Lineament.
1190′ — *Altitude in feet above mean sea level.*
Muskeg or swamp.
R, F — *River, creek, stream, R = rapids; F = falls.*
Motor road.
Trail, portage, winter road.
Building.
□ Pit — *Test pit.*
MA — *Magnetic attraction.*
XXX — *Interprovincial boundary with mile post, approximate position only.*
7 — *Township boundary with mile post, approximate position only.*

SOURCES OF INFORMATION

Geology by J. C. Davies and assistants 1961 and 1962.

Geological maps and drill hole plans of mining companies.

Ontario Department of Mines—Geological Survey of Canada, aeromagnetic maps 1187G, 1192G.

Preliminary maps, P. 181, Gundy Township and P. 182 Broderick Township, scale 1 inch to ¼ mile, issued 1962.

Cartography by F. W. Dawson and P. E. Sorrell, Ontario Department of Mines, 1964.

Base map derived from maps of the Forests Resources Inventory, Ontario Department of Lands and Forests, with additional information by J. C. Davies.

Magnetic declination in the area was 7° E., 1962.

NOTES

Air photographs, geophysical maps and assessment data are filed in the office of the Resident Geologist, Ontario Department of Mines, Kenora.

Map 2069
Ewart-Forgie Area

ONTARIO
DEPARTMENT OF MINES
HON. G. C. WARDROPE, *Minister of Mines*
D. P. Douglass, *Deputy Minister*   M. E. Hurst, *Director, Geological Branch*

SYMBOLS

- Glacial striae.
- Small rock outcrop.
- Boundary of rock outcrop.
- Geological boundary.
- Strike and dip; direction of top unknown.
- Strike and vertical dip; direction of top unknown.
- Strike and dip; top in direction of arrow.
- Strike and dip of overturned bedding; beds face in direction of arrow and dip in direction of loop.
- Folded bedding, with dip.
- Direction in which lava flows face as indicated by shape of pillows.
- Synclinal axis.
- Anticlinal axis.
- Strike and dip of schistosity.
- Strike of vertical schistosity.
- Strike of schistosity, dip unknown.
- Strike and dip of gneissosity.
- Strike of vertical gneissosity.
- Lineation (plunge known).
- Jointing, inclined.
- Jointing, vertical.
- Drag-folds. (Arrow indicates direction of plunge).
- Fault, indicated or assumed.
- Lineaments.
- Muskeg or swamp.
- River, creek, stream, R = rapids; F = falls.
- Motor road. Provincial highway number encircled where applicable.
- Other road.
- Trail, portage, winter road.
- Building.
- Shaft, vertical.
- Pit — Test pit.
- Open cut, quarry, gravel pit.
- Tr. — Trench.
- AV — Assay values in gold over 0.05 oz. per ton.
- MA — Magnetic attraction.
- XX — Interprovincial boundary with mile post, approximate position only.
- 5 — Township boundary with mile post, approximate position only.
- Indian Reserve boundary, approximate position only.
- Claim line, surveyed.
- (5) — Location of mining property.

SOURCES OF INFORMATION

Geology by J. C. Davies and assistants 1961 and 1962. Geological maps and drill hole plans of mining companies.

Ontario Department of Mines—Geological Survey of Canada, aeromagnetic maps 1186G, 1187G, 1191G, 1192G.

Preliminary maps, P. 144, Ewart Township and P. 145, Forgie Township, scale 1 inch to ¼ mile, issued 1962.

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Magnetic declination in the area was 7° E., 1962.

NOTES

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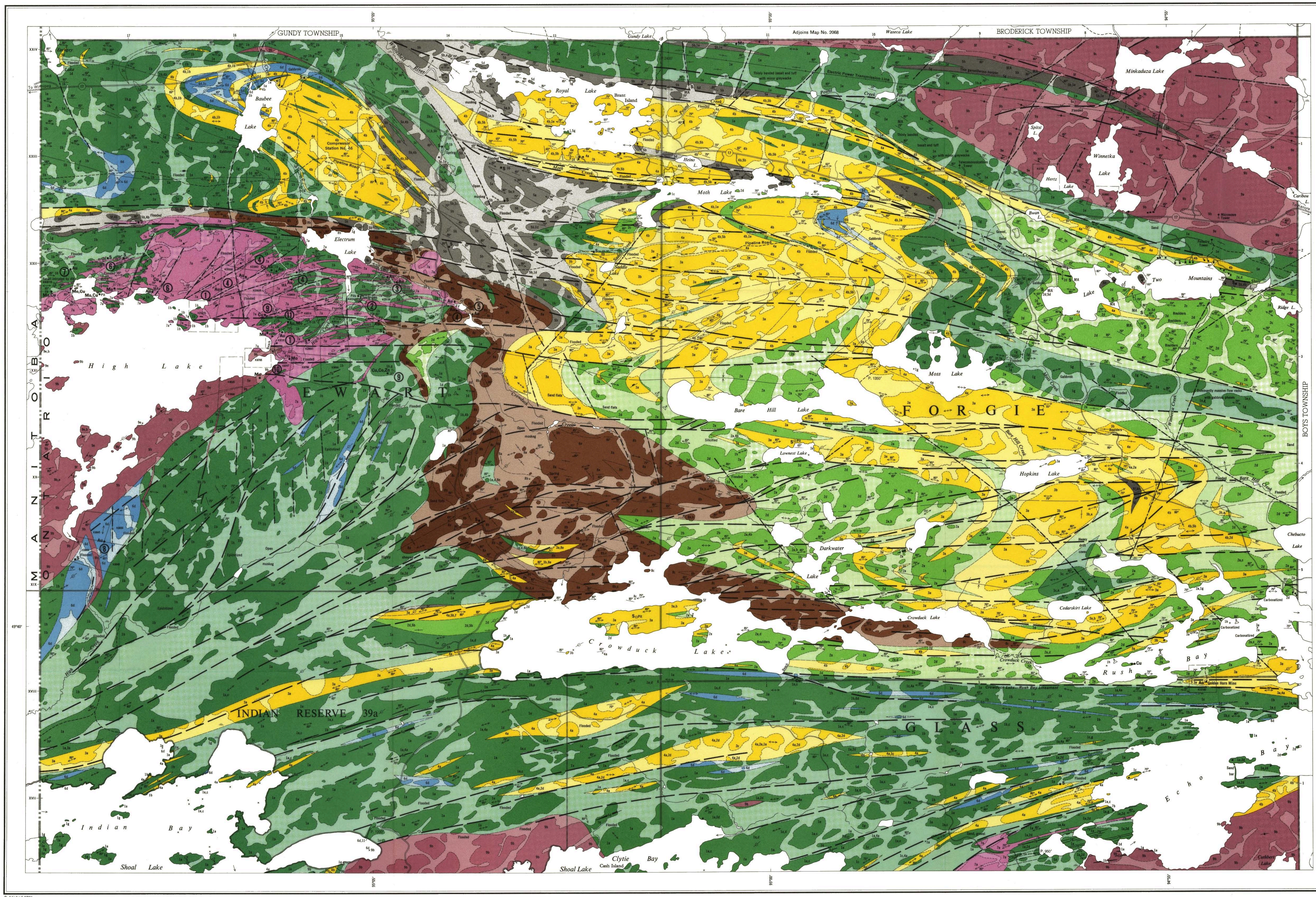
Generalization of complex geology in the area near High Lake has limited the extent to which the geology could be tied to surveyed claim lines. The surveyed boundary of Indian Reserve 39a could not be located in 1961-62, but geology is tied to all other surveyed lines. The geology is also tied to secondary roads, located during the present survey by pace and compass methods.

LIST OF PROPERTIES

1. San Antonio Gold Mines Ltd. (1953).
2. Kenopo Mining & Milling Co. Ltd. (1938).
3. Purdex Minerals Ltd. (1958).
4. Electrum Lake Gold Mines Ltd. (1960).
5. Hoey Grubstake (1959) Syndicate.
6. Selco Exploration Co. Ltd. (1961).
7. Bardyke Mines Ltd. (1961).
8. McCallum F.
9. Alcock C.A.
10. Evenlode Mines Ltd.
11. Francoeur Mines Ltd. (1958).



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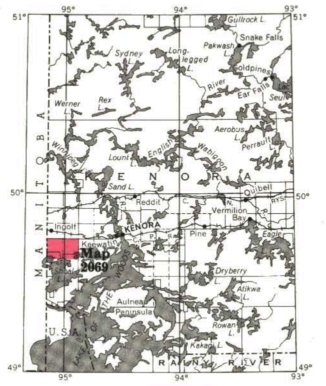

Scale 1 inch to 50 miles

N.T.S. reference 52 E/10, 52 E/11

LEGEND

CENOZOIC*

RECENT
Lake, stream and swamp deposits.

PLEISTOCENE
Sand, gravel, clay.

GREAT UNCONFORMITY

PRECAMBRIAN**

PROTEROZOIC

11 Diabase.

INTRUSIVE CONTACT

ARCHEAN

LATER ACID INTRUSIVE ROCKS

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INTRUSIVE CONTACT

9a Quartz monzonite.
9b Grey granodiorite.
9c Gneissic hornblende-biotite granodiorite, with aplite, pegmatite, and dark inclusions.
9d Grey granodiorite with much pink granodiorite.
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8a Argillite and cherty argillite.
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6b Hornblende diorite.
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4b Massive fine-grained rhyolitic and dacitic tuff.

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INTERMEDIATE VOLCANIC ROCKS

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2b Porphyritic andesite.
2c Andesite-dacite agglomerate.
2d Andesite-dacite tuff, agglomerate and flows.

BASIC VOLCANIC ROCKS

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1b Basalt.
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1d Agglomerate and tuff.
1e Interbanded lensy tuff, flows and sediments.
1f Hornblende-biotite-plagioclase schist.
1g Gabbro, coarse-grained tuff and flows (possibly gabbro).
1h Pillow lava.

Au	*Gold.*
Co	*Cobalt.*
Cu	*Copper.*
Electrum	*Electrum.*
Mo	*Molybdenum.*
S	*Sulphide mineralization.*
Sb	*Antimony.*
Zn	*Zinc.*

**Unconsolidated deposits. In general, Cenozoic deposits are represented by the lighter coloured parts of the map.*

***Bedrock geology. Outcrops and inferred extensions of each rock map unit are shown respectively in deep and light tones of the same colour. Where in places a formation is too narrow to show colour and must be represented in black, a short black bar appears in the appropriate block.*

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With the exception of formation 11 which is mapped on this sheet, formations without colour in the legend blocks are mapped on the companion sheet.

Map 2069

EWART-FORGIE AREA

KENORA DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

Chains 80 60 40 20 0 1 2 Miles
Metres 1000 0 1 2 3 Kilometres
Feet 1000 0 5,000 10,000 Feet