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Report 222

Geology of the

Straw Lake Area

Districts of Kenora and Rainy River

By

G.R. Edwards

1983

Ministry of
Natural
Resources

Ontario

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Minister

W.T. Foster
Deputy Minister

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FOREWORD

STRAW LAKE AREA

This report is the final phase of detailed mapping of the southwestern part of the Wabigoon Subprovince, east of Highway 71 in the Nestor Falls area. The area contains Early Precambrian (Archean) metavolcanic and metasedimentary rocks, with bordering granitic rocks, on both sides of the Manitou Stretch-Pipestone Lake Fault which is part of a regional fault. The Straw Lake Beach Mine, a former producer, is suggested to be related to hydrothermal deposition of gold associated with intrusion of the Lawrence Lake Batholith. Copper mineralization in mafic flows at Sullivan Lake is compared to the Maybrun occurrence. These suggestions of regional-scale controls of two mineral deposit types enhance the mineral potential of a wide area.

E.G. Pye
Director
Ontario Geological Survey

CONTENTS

PAGE

Abstract ... ix
Introduction ... 1
Exploration Activity ... 1
Means of Access ... 3
Present Geological Survey ... 3
Previous Geological Work ... 3
Physiography ... 4
Acknowledgments ... 4

General Geology ... 5
Table of Lithologic Units ... 6
Precambrian ... 7
Early Precambrian (Archean) ... 7
Metavolcanics and Metasediments ... 7
Mafic Metavolcanics ... 7
North of the Manitou Stretch-Pipestone Lake Fault ... 7
Straw Lake and East ... 8
South of the Manitou Stretch-Pipestone Lake Fault ... 10
Flows ... 10
Pyroclastic Rocks ... 11
Flow Breccia ... 11
Hyaloclastic Breccia, Aquagene Tuff, Tuff, Lapilli-Tuff, and Tuff-Breccia ... 12
Tuff-Breccia and Lapilli-Tuff ... 13
Petrography ... 15
Intermediate Metavolcanics ... 15
North of the Manitou Stretch-Pipestone Lake Fault ... 15
Flows ... 16
Pyroclastic Rocks ... 18
Yoke Lake ... 18
Tuff-Breccia and Agglomeratic Tuff-Breccia ... 18
Lapilli-Tuff, Crystal Tuff, and Tuff ... 19
Bluffpoint Lake ... 19
South of the Manitou Stretch-Pipestone Lake Fault ... 20
Petrography ... 20
Felsic Metavolcanics ... 21
North of the Manitou Stretch-Pipestone Lake Fault ... 21
Flows ... 22
Lapilli-Tuff and Tuff-Breccia ... 22
South of the Manitou Stretch-Pipestone Lake Fault ... 23
Petrography ... 24
Clastic Metasediments ... 24
Siltstone and Mudstone ... 25
Fine to Coarse Wacke ... 25
Conglomerate ... 26
Turbidites ... 28
Tuffaceous Metasediments ... 29
Green Tuffwacke ... 30
Petrography ... 30
Chemical Metasediments ... 31
Iron Formation ... 31
Chert and Ferruginous Chert ... 31
Metamorphosed Mafic and Ultramafic Intrusive Rocks ... 31
North of the Manitou Stretch-Pipestone Lake Fault ... 31
Leucocratic Gabbro ... 31
Quartz-Amphibole Gabbro ... 32
Peridotite ... 32
South of the Manitou Stretch-Pipestone Lake Fault ... 32

Line Bay to Sucan Lake ... 32
East of Furlonge and Bending Lady Lakes ... 33
Felsic, Intermediate, and Mafic Intrusive Rocks ... 33
Subvolcanic Rocks ... 33
North of the Manitou Stretch-Pipestone Lake Fault ... 33
South of the Manitou Stretch-Pipestone Lake Fault ... 33
Stocks ... 33
Dikes ... 36
Lawrence Lake Batholith ... 36
Actinolite Diorite and Gabbro ... 37
Diorite and Quartz Diorite ... 37
Granodiorite to Trondhjemite ... 38
Mixed Contact Zone ... 38
Jackfish Lake Complex ... 39
Esox Lake Stock ... 40
Furlonge Lake Stock ... 41
Late Mafic Intrusive Rocks ... 42
Phanerozoic ... 42
Cenozoic ... 42
Quaternary ... 42
Pleistocene ... 42
Till ... 43
Varved Clay ... 43
Raised Beach Deposits ... 43
Sand ... 43
Recent ... 43

Structural Geology ... 43
Folding ... 44
Northern Domain ... 45
Southern Domain ... 46
Thompson Bay Fold Structure ... 46
Esox Lake Fold Structure ... 47
Folding in the Metavolcanics ... 47
Faults ... 48
The Manitou Stretch-Pipestone Lake Fault ... 48
Other Faults ... 49
Late Faults ... 49
Foliation and Schistosity ... 49
Supracrustal Rocks ... 49
Plutonic Rocks ... 50
Gneissosity ... 52
Lineation ... 52
Drag Folds ... 52
Cataclastic Deformation ... 53

Economic Geology ... 54
Suggestions for Exploration ... 54
Gold ... 54
Base Metals ... 55
General ... 55
Copper ... 55
Property Descriptions ... 56
Canadian Nickel Company Ltd. (1) ... 56
Conwest Exploration Company Ltd. [1952] (2) ... 56
Eustace, A.J. (3) ... 57
Freeport Canadian Exploration Company [1971] (4) ... 60
Mathieu, J.A., Estate (5) ... 60
McKay, G.H. (6) ... 60
Minedel Mines Ltd. (7) ... 61
(Straw Lake Beach Mine) ... 61

Projex Ltd. (8) 62
Straw Lake Occurrence [1934?] (9) 62
Viger, S.J., Property (10) 62

References 63
Index 65

TABLES

1–Table of Lithological Units 6

2–Diamond drill and surface trenching data 58

FIGURES

1–Key map showing location of Straw Lake Area viii

2–Major structural features in the supracrustal rocks of the Straw Lake area 45

3–Location of properties and diamond drill sites, Straw Lake area 57

PHOTOGRAPHS

1–Mafic flow breccia, south shore of the large island between Thompson Bay and Pipestone Lake 13

2–Mafic hyaloclastic breccia, Thompson Bay 14

3–Pillowed andesite flow, northern Yoke Lake 16

4–Large quartz amygdule in andesite flow, northern Yoke Lake 17

5–Intermediate agglomeratic tuff-breccia, northern Yoke Lake 18

6–Flame structures in interbedded mudstone and wacke, east of Thompson Bay 26

7–Soft sediment deformation, Thompson Bay 27

8–Wacke dike in siltstone, east of Thompson Bay 28

9–Soft sediment deformation, Thompson Bay 29

10–Autoclastic quartz-feldspar porphyry, Seahorse Lake 34

11–Autoclastic quartz-feldspar porphyry, Esox Lake 35

12–Axial planar cleavage in interbedded mudstone and wacke, Thompson Bay 51

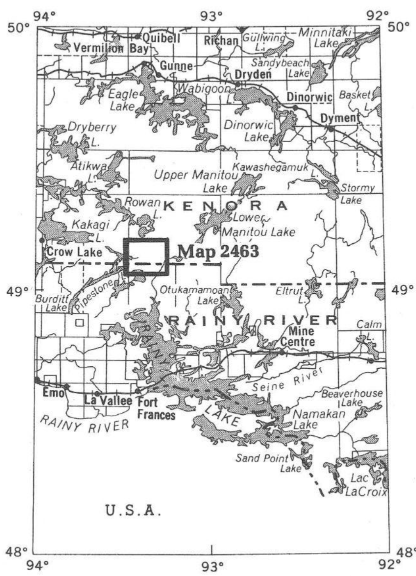
13–Cataclastic deformation of quartz-feldspar porphyry, Esox Lake 53

GEOLOGICAL MAP

(back pocket)

Map 2463 (coloured)–Straw Lake Area, Districts of Kenora and Rainy River.

Scale, 1:31 680 or 1 inch to ½ mile.



SMC 14903

Figure 1–Key map showing location of the Straw Lake area.
Scale 1:3 168 000 or 1 inch to 50 miles.

ABSTRACT

The Straw Lake Area, bounded by Latitudes 49°03.75'N and 49°11.25'N and Longitudes 93°15'W and 93°30'W, is centred 40 km east of Nestor Falls, Ontario.

All bedrock in the area is Early Precambrian (Archean) consisting primarily of steeply dipping folded strata of low-grade metamorphosed and deformed mafic volcanic rocks and lesser intermediate and felsic volcanic rocks and associated intrusive subvolcanic stocks, sheets, and dikes. The metavolcanics are intruded by and bounded by large granitic masses of intermediate to felsic composition, and by minor late lamprophyre and gabbro dikes.

The area is approximately bisected by an east-trending zone of cataclastic deformation, the Manitou Stretch-Pipestone Lake Fault which is of regional dimensions and has been traced from Lake of the Woods in the west to Upper Manitou Lake in the east.

Supracrustal rocks in the map-area north of this fault consist of a lower cycle of submarine mafic flows overlain by interlayered intermediate flows and pyroclastic rocks (at Yoke Lake and north of the Manitou Stretch) with intercalated felsic pyroclastic rocks and possibly felsic domes (east of Straw Lake). Supracrustal rocks in the map-area south of the fault are not correlatable with those north of the fault. They consist of a complexly folded lower sequence (or sequences) of submarine mafic flows capped by mafic flow breccia, hyaloclastite, and tuff-breccia and overlain by mainly volcanic-derived turbiditic metasediments, exhibiting both proximal and distal characteristics. Lenses of minor intermediate and felsic metavolcanics, conglomerate, and associated metasediments are intercalated with the mafic flows near the top of the sequence near Thompson Bay. The mafic flows are cut by composite mafic and ultramafic intrusions, especially southwest of Sucan Lake and by quartz-feldspar porphyry stocks, located southwest of Sucan Lake and at Esox Lake.

The northern part of the supracrustal belt is intruded by the Lawrence Lake Batholith which, in the area is represented by three main phases: an early subordinate, amphibole diorite to gabbro phase at Sullivan Lake; a diorite to quartz diorite phase occurring between Bluffpoint and Harris Lakes; and a later granodiorite to trondhjemite phase occurring south and southwest of Harris Lake. The batholith is partly rimmed by mixed contact subphases consisting of felsite, quartz-rich leucocratic trondhjemite, and metasomatized volcanics.

To the south, the supracrustal belt is bounded by syenodioritic rocks of the Jackfish Lake Complex which is part of the large Rainy Lake Batholith. Mafic metavolcanics in contact with this body have been metamorphosed to hornblende amphibolite rank over a zone up to 2 km wide. In this contact zone, rocks of greenschist facies rank alternate with rocks of amphibolite facies rank at several localities and may represent thrust slices.

Two late diapiric granite to quartz monzonite stocks occur within the belt at Furlonge Lake and Esox Lake.

Gold was mined at the old Straw Lake Beach mine in the 1930s. Several other gold occurrences were worked at that time but none were brought into production. Gold in the area may have been deposited at fracture intersections by hydrothermal fluids mobilized during the emplacement of the Lawrence Lake Batholith. New gold occurrences were also discovered by the field party by random sampling. Brown weathering trondhjemite within the Lawrence Lake Batholith northeast of Floyd Lake yielded grab sample assay results of 0.54 ounce Au/ton. A grab sample of a 2.5 cm wide quartz vein in a quartz-feldspar porphyry dike north of Yoke Lake assayed 0.32 ounce Au/ton (Geoscience Laboratories, Ontario Geological Survey, Toronto).

Massive to disseminated chalcopyrite, pyrite, malachite, and azurite occurs in amygdules and as replacement of a mafic flow at Sullivan Lake. A selected grab sample of this rock analyzed 7.40 percent copper and 0.18 ounce Au/ton (Geoscience Laboratories, Ontario Geological Survey, Toronto). This copper and gold occurrence may be of similar genesis as the copper and gold at Maybrun Mine located on the west shore of Head Bay, Atikwa Lake, where chalcopyrite, at least in part occupies pillow interstices in mafic flows.

A selected grab sample taken from a 5 cm to 10 cm wide sulphide vein at the shaft opening of the old Konigson Occurrence analyzed 8.81 percent copper and 1.16 ounces Au/ton (Geoscience Laboratories, Ontario Geological Survey, Toronto).

It is recommended by the author that the area be explored for gold especially in areas of intersecting cleavage between the Lawrence Lake Batholith and the Manitou Stretch-Pipestone Lake Fault, as well as in alteration zones within the batholith, especially near the margins. The copper occurrence at Sullivan Lake could be a cupreous pyrite-type deposit related to successive phases of early mafic volcanism. A possible relationship also exists between the diorite and more mafic intrusions located at the margins of the Lawrence Lake and Atikwa Lake Batholiths.

Geology of the Straw Lake Area, Districts of Kenora and Rainy River, by G.R. Edwards, Ontario Geological Survey Report 222, 67p.
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CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

If the reader wishes to convert imperial units to SI (metric) units or SI units to imperial units the following multipliers should be used:

CONVERSION FROM SI TO IMPERIAL			CONVERSION FROM IMPERIAL TO SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm²	0.155 0	square inches	1 square inch	**6.451 6**	cm²
1 m²	10.763 9	square feet	1 square foot	**0.092 903 04**	m²
1 km²	0.386 10	square miles	1 square mile	2.589 988	km²
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm³	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm³
1 m³	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m³
1 m³	1.308 0	cubic yards	1 cubic yard	0.764 555	m³
			CAPACITY		
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
			MASS		
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
			CONCENTRATION		
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy)/ton (short)	20.0	pennyweights/ton (short)
1 pennyweight/ton (short)	0.05	ounce (troy)/ton (short)

NOTE–Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries published by The Mining Association of Canada in co-operation with the Coal Association of Canada.

Geology of the

Straw Lake Area

Districts of Kenora and Rainy River

by

G.R. Edwards[1]

INTRODUCTION

The map-area is bounded by Latitudes 49°03.75'N and 49°11.25'N and Longitudes 93°15'W and 93°30'W and is centred 40 km east of Nestor Falls, a small community located on Highway 71, midway between Kenora and Fort Frances. Although float-equipped aircraft were used for access, most of the area can be reached by canoe either from the southwest (Pipestone Lake), the south (Rainy Lake and Fort Frances) or from the northeast (the Manitou Lakes).

Exploration Activity

Gold motivated prospecting in the area as early as the late nineteenth century but significant finds were not made until 1933 (Thomson 1935) when gold was discovered at four locations on or near Straw Lake. These are *a)* the Konigson Occurrence (3),[2] *b)* the Straw Lake Beach Mine (7), *c)* the Straw Lake Occurrence (9), and *d)* the S.J. Viger Occurrence (10).

a) The Konigson Occurrence (Ferguson *et al.* 1971), discovered by E. Konigson in mineralized, schistose, intermediate pyroclastic rocks on the north shore of Straw Lake, is a patented property (K2550). The first recorded examination of this property was in 1933 by W. Smith (Thomson 1935). Work on the claim consisted of thorough stripping, mapping, and much trenching. In addition, a shaft was sunk 40 feet at the discovery sight. At least 1,119 feet of diamond drilling was performed in six holes spaced 50 feet apart along the suspected mineralized zone (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

---

[1]Geologist, Precambrian Geology Section, Ontario Geological Survey, Toronto. Manuscript approved for publication by the Chief Geologist, February 4, 1980. This report is published with permission of E.G. Pye, Director, Ontario Geological Survey.

[2]The number in parentheses refers to the property number on Map 2463, back pocket.

b) The Straw Lake Beach Mine (past producer) was initially discovered by M. Mosher and F. Grozelle in 1933 (Thomson 1935) south of the northeast arm of Straw Lake. Gold here occurs mainly in a mineralized quartz vein in schistose felsic metavolcanics. Trenching, stripping, and pitting was performed by Moneta-Porcupine Mines Limited in 1933 and 1934. From 1934 to 1941 work performed by Straw Lake Beach Gold Mines Limited included trenching, 11 surface diamond-drill holes totalling 3,579 feet, a shaft 723 feet deep with levels at 100, 200, 300, 425, 575, and 700 feet, and a winze 180 feet east of the shaft sunk from the 425 to the 465 foot depth with a level at 465 feet. Total drifting and crosscutting were 4,125 feet and 506 feet respectively. Production (1938 to 1941) was 11,568 oz. Au and 1,049 oz. Ag from 33,662 tons of ore. The shaft is located on patented claim K3944 (Ferguson *et al.* 1971). During the summer of 1976 geological mapping and diamond drilling were performed in the mine area by Projex Limited for Minedel Mines Limited. The results of this exploration work are at the time of writing not known to the author.
c) The Straw Lake Occurrence was discovered south of Straw Lake by W. Lucy in a feldspar porphyry dike. In 1934 the Straw Lake Mining Syndicate carried out surface stripping and pitting on patented claims K4016 and K4017 (Thomson 1936). No records of diamond drilling were found by the author.
d) The S.J. Viger Occurrence located east of the southeast arm of Straw Lake on patented claims K4290, K4291, and K4292 was discovered by O. Viger about the same time as the other occurrences on Straw Lake. No records of exploration work except for copies of Assay Certificates (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora) were found by the author.

Small quantities of gold were discovered north of Line Bay, Pipestone Lake in 1934 by C. Phinney and G. Sullivan and Sons and apparently by J. Prout in adjoining claims (Thomson 1936). Exploration appears to have been mainly stripping and trenching as no records of diamond drilling are preserved.

Recorded assessment data stored at the Assessment Files Research Office, Ontario Geological Survey, Toronto show that at least the following work has been performed in exploration for base metals. *a)* The Canadian Nickel Company Limited (1) diamond drilled at eleven locations for a total footage of 4,267 feet. Drilling was to test electromagnetic and magnetic targets. *b)* In 1971 the Freeport Canadian Exploration Company (4) diamond drilled 2,625 feet at eight locations following a large-scale airborne electromagnetic survey.

Records of the Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora indicate that a ground magnetometer survey and diamond drilling program was undertaken in 1952 by Conwest Exploration Company Limited (2) in the Furlonge Lake area in an effort to further delineate a number of visible pyrite (and pyrrhotite) showings which occur along the shore of the lake. Diamond drilling was performed at six locations but no depths or intersections have been recorded. No record of further work was found by the author.

The Canadian Nickel Company Limited still holds two claims 900 m north of Lou Lake. Several patented claims on and adjacent to the Konigson Occurrence, the Straw Lake Beach Mine, The Straw Lake Occurrence, and the S.J. Viger Occurrence are held in good standing as well as a block of eight patented claims north and west of Mister Lake. Twelve new claims surrounding the

Straw Lake Beach Mine patented property were staked by Projex Limited (8) in the summer of 1976.

Means of Access

Natural waterways facilitate penetration to within 2 km of any point in the map-area. Pipestone Lake (Thompson Bay) is accessible by boat from the north end of Highway 615 on Burditt (Clearwater) Lake, 45 km northwest of Fort Frances. From Thompson Bay, portages give access to Yoke, Crossroute, and Sullivan Lakes as well as Straw, Sucan, and Bluffpoint Lakes. Floyd Lake may be reached along the creek from Straw Lake by canoe provided the water level is high enough. Kaiarskons and Furlonge Lakes are best reached from the South by way of portage from Loonhaunt Lake which eventually connects up with Rainy Lake to the south. There is a swampy portage between Furlonge and Sucan Lakes. The eastern part of the map-area, including Esox, Mister, Missus, and Harris Lakes and the Manitou Stretch can be reached with some portages either from Rainy Lake to the south, along the Manitou River or from the northwest, down the Manitou chain of lakes.

A new highway connecting with Highway 11 to the south has been constructed since the area was mapped. Forestry roads from this highway now provide access to Straw Lake.

Present Geological Survey

Mapping was performed by the author and assistants in the spring and summer of 1976. The pace-and-compass method was employed, recording outcrop location and shape and field data on air photographs (1:15 840 or 1 inch to ¼ mile). Traverses were laid out in such a fashion as to attempt (a) to see as much outcrop as possible, and (b) to cross the strike of the units. Where exposure is poor, an effort was made, using air photographs, to outline possible outcrop areas and give these areas priority when traversing. Field data were transferred to a base map prepared by the Cartography Section of the Division of Lands, Ministry of Natural Resources (scale 1:15 840 or 1 inch to ¼ mile). A preliminary geological map at a scale of 1 inch to ¼ mile was published at an earlier date (Edwards and Sutcliffe 1977).

Previous Geological Work

Most of the Straw Lake area was described by J.E. Thomson (1935, 1936). Earlier reconnaissance work was performed by A.C. Lawson (1889) and A.P. Coleman (1895, 1897). Regional geological relationships were synthesized by A.M. Goodwin (1965) and were compiled on the Kenora-Fort Frances Sheet, Map 2115 by J.C. Davies and A.P. Pryslak (1967). Recent mapping on a detailed scale was performed by G.R. Edwards (1978, 1980) in adjacent areas to the west. In the near region, detailed and semi-detailed mapping has been performed by C.E. Blackburn (1973, 1976a, 1976b, 1979a, 1979b) in the Otukamamoan, Off Lake-Burditt Lake, Lower Manitou-Uphill Lake, Upper Manitou Lake, and Boyer-Meggisi Lakes areas; by L. Kaye (1973, 1974) in the Rowan Lake and Crow Lake areas; and by J.C. Davies and J.A. Morin (1976) in the Cedartree Lake area.

Physiography

Topography in the map-area is typical of Canadian Shield areas with about 20 percent outcrop exposure. Maximum elevation is just over 1,400 feet occurring between Kaiarskons Lake and Pipestone Lake and west-northwest of Cedar Narrows. The point of lowest elevation is Pipestone Lake (1,160 feet). Local relief features of over 150 feet occur especially northwest of Straw Lake and along the north shore of the central part of Yoke Lake which is an area of plateau-like hills and bluffs. The country is less rugged east of Bluffpoint Lake (in the Lawrence Lake Batholith) and east of Straw Lake.

Rock exposure is poor just east of Line Bay (Pipestone Lake), in the areas surrounding Furlonge Lake, and between the Manitou Stretch and Mister Lake as a result of variable thicknesses of glacial till. Sandy glacial deposits have obscured much of the rock in the vicinity of Lou Lake. In general, the Manitou Stretch-Pipestone Lake Fault zone is also poorly exposed.

Kaiarskons Lake has at some time in the recent past had a water level somewhat higher than at present. This was reported by Thomson (1936) and was attributed to logging in the early part of the century. The lake level was up long enough for the formation of raised boulder beaches and raised flat sandy areas along much of the shoreline.

The level of Esox Lake (and the Manitou Lakes) has been raised by a dam just south of the map-area on the Manitou River and there is no longer a "Manitou Rapids" between Esox Lake and the Manitou Stretch. The channels however are shallow and should be approached with caution in motor boats and canoes.

All natural waterways in the map-area are part of the Arctic watershed, draining south into Rainy Lake, which, via the Rainy River empties into the Lake of the Woods.

Acknowledgments

Capable assistance in the field was provided by Richard Sutcliffe, John Batiuk, David Guindon, and Kirk Osadetz. Richard Sutcliffe, as senior assistant, was responsible for part of the mapping and interpretation.

GENERAL GEOLOGY

All bedrock in the area is Early Precambrian (Archean) in age.

The map-area is divided in two by the east-trending Manitou Stretch-Pipestone Lake Fault zone. This joins up to the west with the Pipestone-Cameron Lakes Fault (Edwards 1980) and probably with the Manitou Straits Fault (Blackburn 1976b) to the east.

Most of the rocks north of the fault are interlayered, steeply dipping, folded mafic, intermediate, and felsic metavolcanics trending from north-northwest to east-northeast around the Lawrence Lake Batholith. Felsic pyroclastic rocks and flows predominate east of Straw Lake with intermediate pyroclastic rocks being more abundant south of Floyd Lake. Subvolcanic, felsic porphyry "sheets" are especially common in this zone. The Yoke Lake area and the northwest shore of Straw Lake are underlain by andesitic flows and pyroclastic rocks intercalated with lesser mafic and felsic metavolcanics. Some of the rocks in this area are quite fresh. The composite Lawrence Lake Batholith, consisting in the area mainly of altered biotite-hornblende diorite and quartz diorite and later hornblende-biotite trondhjemite and granodiorite, intruded and apparently caused deformation and some metasomatism of the volcanic rocks north of the fault.

Submarine mafic flows (basalt) stratigraphically form the lowest identifiable sequence in steeply dipping, doubly folded rocks south of the Manitou Stretch-Pipestone Lake Fault. These are interlayered with intermediate and felsic pyroclastic rocks southwest of Sucan Lake and northeast of Line Bay, Pipestone Lake. At the latter location, pebble and cobble conglomerate and arkosic wacke and possible arenite are interbedded with the pyroclastic rocks. In the vicinity of Thompson Bay, the mafic flows are capped by mafic pyroclastic and hyaloclastic rocks which are in turn overlain mainly by arkosic wacke and turbidite arkosic wacke-siltstone at Thompson Bay.

A similar sequence of sedimentary rocks is north and west of Esox Lake but here mafic fragmental rocks do not appear to be as common between the sedimentary rocks and the underlying mafic flows. A fault slice of sedimentary rocks occurs along the Manitou Stretch-Pipestone Lake Fault extending westward from Manitou Stretch. Apparently infolded sedimentary rocks also occur 1830 m west of Lou Lake.

Composite sills or sheets of gabbro, leucogabbro, and altered peridotite intrude mafic flows between Line Bay, Pipestone Lake and Sucan Lake. A swarm of felsic porphyry and leucocratic trondhjemite dikes intrude mafic flows east of Sucan Lake. Metamorphosed, subvolcanic, felsic porphyry stocks intrude metavolcanics and metamorphosed mafic intrusive rocks 915 m southwest of Sucan Lake and mafic metavolcanics in the vicinity of the southern part of Esox Lake.

Late granite to quartz monzonite stocks are within the supracrustal belt between Esox and Seahorse Lakes (the Esox Lake Stock) and between Bending Lady and Furlonge Lakes (the Furlonge Lake Stock). Syenodiorite and related rocks of the Jackfish Lake (intrusive) Complex (Blackburn 1976a; Edwards 1978) which is part of the Rainy Lake Batholith, borders the belt to the south.

TABLE 1 | TABLE OF LITHOLOGIC UNITS FOR STRAW LAKE AREA

PHANEROZOIC

CENOZOIC

QUATERNARY

PLEISTOCENE AND RECENT

Till, lacustrine clay, sand, raised beach deposits, unconsolidated swamp, stream and lake deposits.

PRECAMBRIAN

EARLY PRECAMBRIAN (ARCHEAN)

LATE MAFIC INTRUSIVE ROCKS

Amphibole (pyroxene) porphyry, equigranular biotite-actinolite gabbro, biotite lamprophyre.

Intrusive Contact

FELSIC, INTERMEDIATE, AND MAFIC INTRUSIVE ROCKS

ESOX AND FURLONGE LAKE STOCKS

Leucocratic quartz monzonite and granite, porphyritic quartz monzonite, stromatic and agmatic contact migmatite.

Intrusive Contact

JACKFISH LAKE COMPLEX

Hornblende syenodiorite, porphyritic hornblende syenodiorite, porphyritic quartz monzonite, aplite, pegmatite, leucocratic biotite trondhjemite, hornblende diorite, leucocratic biotite gneiss, stromatic and agmatic contact migmatite.

Intrusive Contact

LAWRENCE LAKE BATHOLITH

Biotite-hornblende diorite, biotite-hornblende quartz diorite, actinolite diorite, granodiorite, trondhjemite, porphyritic dikes, aplitic and felsite dikes, gabbro, ultramafic rocks.

SUBVOLCANIC ROCKS

ESOX LAKE PORPHYRY

Biotite-feldspar-quartz porphyry, biotite-quartz-feldspar porphyry, autobreccia, cataclastic breccia, sericite schist, phyllonite.

DIKE ROCKS

Quartz-feldspar porphyry, feldspar porphyry, amphibole (chlorite)--quartz-feldspar porphyry, felsite, leucocratic biotite trondhjemite, carbonate-sericite schist.

METAMORPHOSED MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

Serpentinized and/or talc-carbonatized peridotite and pyroxenite, gabbro, quartz-amphibole gabbro, leucocratic gabbro, gabbroic anorthosite, ophitic gabbro, porphyritic gabbro, amphibolite magnetite-bearing gabbro.

METAVOLCANICS AND METASEDIMENTS

CHEMICAL METASEDIMENTS

Chert, ferruginous chert, iron formation.

CLASTIC METASEDIMENTS

Arkosic wacke (sandstone), siltstone, mudstone, conglomerate, tuffaceous wacke (tuffwacke) green tuffaceous wacke (tuffwacke), schistose metasediments, carbonatized metasediments, graphitic regolith-like conglomerate, graphitic metasediments.

FELSIC METAVOLCANICS

Flow, tuff-breccia, lapilli-tuff, tuff, fragmental flow, sericite schist, carbonatized metavolcanics.

INTERMEDIATE METAVOLCANICS

Flow, tuff-breccia, agglomeratic tuff-breccia, lapilli-tuff, tuff, crystal tuff, porphyritic flow, chlorite-sericite schist, carbonatized metavolcanics, metasomatized metavolcanics.

MAFIC METAVOLCANICS

Flow, pillowed flow, amygdaloidal flow, variolitic flow, massive flow, coarse-grained flow, porphyritic flow, flow breccia, pillow breccia, hyaloclastic breccia aquagene tuff, tuff-breccia, agglomeratic tuff-breccia, lapilli-tuff, tuff, chlorite schist, magnetite-garnet-biotite-feldspar-hornblende schist and gneiss, amphibolite, magnetite-bearing metavolcanics, carbonatized metavolcanics, hornfels, metasomatized metavolcanics.

Precambrian

EARLY PRECAMBRIAN (ARCHEAN)

Metavolcanics and Metasediments

MAFIC METAVOLCANICS

North of the Manitou Stretch-Pipestone Lake Fault

Submarine mafic flows and minor interbedded mafic tuff and lapilli-tuff and tuff-breccia exposed west and northwest of Yoke Lake together form the stratigraphically lowest identifiable sequence in this area. Most of the sequence is roughly northeast-trending and is continuous with a thick southeast-facing series south of Brooks Lake in the Schistose Lake Area (Edwards 1980).

Mafic volcanic rocks belonging to the same sequence are folded around, south of Yoke Lake, along the north shore of Thompson Bay into a strongly deformed zone associated with the Manitou Stretch-Pipestone Lake Fault north of Pipestone Creek and east to Straw Lake. The sequence may also be continuous across Straw Lake where mafic volcanic rocks, mainly fragmental in nature trend eastward in the strongly deformed pinch zone between the Lawrence Lake Batholith and the Manitou Stretch-Pipestone Lake Fault.

North of the Manitou Stretch-Pipestone Lake Fault, pillowed flows are common, and weathered surfaces of the flows tend to be pale greenish brown to pale green or grey rather than reddish green. In the Holstein Lake area, however, most of the flows are massive, fine to medium grained and rarely coarse grained exhibiting knobby (pseudomorphic amphibole) texture. Few pillowed units are present. Flows in this area are generally pale green on the fresh surface and have a characteristic reddish green colour on the weathered surfaces.

Sparse plagioclase phenocrysts are common in both the massive and pillowed flows and seldom exceed 1 cm in length. One outcrop of mafic flow north of Yoke Lake contains as much as 80 percent plagioclase phenocrysts up to 5 cm in diameter.

Varioles are common in the pillowed flows south of Holstein Lake. A variolitic pillowed flow in an outcrop between the northwest arm of Yoke Lake and the small unnamed lobe to the west contains varioles 2 to 3 mm in diameter and as many as 4 or 5 may occur in a square centimetre area.

Pillowed flows commonly contain amygdules. They are generally carbonate-filled and are weathered out at surface. Sizes are variable but seldom exceed 1.5 cm in diameter.

In some areas green, magnetite-bearing flows are interbedded with the more typical pillowed flows.

Magnetite-bearing flows occur in the vicinity of the north shore of Thompson Bay and in isolated locations along strike in an arc around Yoke Lake as far as Sullivan Lake. These may form a stratigraphically correlatable set of flows as they occur near the top of the mafic flow sequence. In one outcrop north of Thompson Bay, west of the portage into Yoke Lake, a magnetite-bearing mafic flow has varioles, pillows, and a breccia horizon. Magnetite-bearing flows are thought by the author to be higher stratigraphic level extrusive equivalents of the (magnetite) quartz-amphibole gabbro of the Pipestone Lake area (Edwards 1978).

Where mafic flows are deformed, fresh colour is usually darker green as a result of the formation of chlorite. This is evident in several sheared zones in the Bartley and Crossroute Lakes areas and west of Yoke Lake.

Flows are generally darker green in areas adjacent to the numerous concordant felsic sheets which have intruded them. These sheets are less than 70 m wide and are fine-grained leucocratic trondhjemite, quartz-feldspar porphyry, or felsite. The larger ones have been traced for up to 1000 m along strike.

Carbonatization has affected many rocks in the deformed zones especially those near the Manitou Stretch-Pipestone Lake Fault. Carbonatized flows generally weather a brown to brownish or reddish green depending on the degree of carbonatization.

North of Yoke Lake near the top of the mafic flow successive lenses of intermediate tuff are interbedded with the mafic flows. Intermediate to mafic flows and pyroclastic rocks and lesser felsic pyroclastic rocks overlie the mafic flows and form the core of a lobate syncline at Yoke Lake.

STRAW LAKE AND EAST

Mafic metavolcanics exposed along the west shore and on the islands of central Straw Lake are mainly fragmental. Typically the pyroclastic rocks are lapilli-tuff and tuff-breccia with a chloritic, commonly plagioclase phenocryst-rich matrix forming less than 30 percent of the rock. Aphanitic fragments are generally lighter coloured than the matrix (beige to light green) and are commonly amygdaloidal and plagioclase porphyritic with little compositional variation. Rocks mapped as mafic pyroclastic rocks on the west shore of Straw Lake, near the portage into Yoke Lake, are lighter in colour than those on the islands and may be closer to intermediate in composition.

Possible mafic tuff occurs along the north shore of the island east-northeast of the largest island in Straw Lake. The green tuff is texturally different from the flows and has a grittier surface. In hand specimen the rock contains sparse small (1 mm) plagioclase phenocrysts.

In the area around the southeastern part of Straw Lake, massive, mafic flows and possibly tuff are exposed. The degree of deformation has increased here but some pyroclastic horizons were identified. Possible carbonatized mafic lapilli-tuff to tuff-breccia occur on a small island close to the shore on the north side of the entrance to the southeast bay of Straw Lake.

East of Straw Lake, mafic flows and subordinate pyroclastic rocks are interfingered with felsic metavolcanics in a semi-continuous fashion. A pale green plagioclase porphyritic unit extends from the small lake 1000 m south of the east end of Straw Lake eastward and pinches out in felsic and intermediate metavolcanics east of the small lake southwest of Floyd Lake. This unit is distinctive in that the plagioclase phenocrysts are small laths up to 5 mm long and comprise up to 30 percent of the rock. This differs from the roughly equant crystals more commonly found in the basalt. The prismatic nature of plagioclase phenocrysts is also characteristic of the "andesitic" flows in the core of the Yoke Lake Syncline and therefore these rocks are probably akin to them.

A lenticular body of mafic (possibly intermediate) flow occurs 500 m south of the east tip of Straw Lake in felsic metavolcanics. The rock is considerably altered, is pale green to brownish green, and was identified as flow by the presence of sparse quartz-filled amygdules. This particular body may be continuous or semi-continuous eastward to Mister Lake as similar rocks are along strike at several locations.

A unit of green, coarse-grained mafic flows extends from just west of the west shore and along much of the south shore of Mister Lake.

A mafic pyroclastic unit consisting of lapilli-tuff, tuff-breccia, and minor broken pillow flow (pillow breccia) extends south-southwest from the south shore of the unnamed lake between Missus and Floyd Lakes. This unit appears to be continuous with a 160 m wide zone of a pale green porphyritic mafic (possibly andesitic) flow containing lath-shaped plagioclase phenocrysts similar to those described previously. This zone extends between Mister and Missus Lakes and beyond the map-area. Similar rocks are on the east shore of the lake between Missus and Floyd Lakes and also at the west end of the lake.

North of Manitou Stretch and adjacent to the Manitou Stretch is a 660 m wide band of mafic metavolcanics consisting of mixed pyroclastic and flow units. Some flows contain lath-shaped phenocrysts as previously described. Large 1 to 2.5 m thickly selvaged pillows are present in a 160 m thick amygdaloidal flow west and slightly north of the small lake north of Manitou Stretch. This rock weathers pale brownish green but has a pale green fresh surface. Lath-shaped plagioclase phenocrysts (less than 5 mm in diameter) are sparse. This flow resembles similar pillowed flows in the core of the syncline at Yoke Lake.

Pillows more like those found in the more typical mafic flows were observed by the author in the same band of mafic metavolcanics just east of the map-area 160 m north of Manitou Stretch.

Green, coarse-grained mafic flows occur on the north shore of the small lake at the east edge of the map-area 760 m north of Manitou Stretch.

South of the Manitou Stretch-Pipestone Lake Fault

To the author's knowledge, in the Straw Lake map-area, rocks south of the Manitou Stretch-Pipestone Lake Fault cannot be correlated stratigraphically with those north of the fault and have therefore been described separately. The structure in this southern block is more complex than the simply folded block to the north. The stratigraphic succession in this southern block consists of pillowed and to a lesser extent massive mafic flows intercalated with minor felsic and intermediate metavolcanics overlain by mafic pyroclastic and hyaloclastic rocks which are in turn overlain by metasediments.

FLOWS

Much of the area between the Manitou Stretch-Pipestone Lake Fault and the Jackfish Lake Complex is underlain by mafic flows. These form the lowest identifiable stratigraphic sequence in this block.

Except for mafic flows southwest of Thompson Bay, much of the mafic sequence has a well developed regional foliation. Deformation of the fabric of these rocks increases southward toward the contact with the Jackfish Lake Complex (see section "Structural Geology") with the development of a strong east-trending schistosity and/or gneissosity. The widest identifiable, uninterrupted sequence of flows in this block occurs southwest of Thompson Bay on the northwest limb of the Thompson Bay anticline. This northeast-trending sequence is 2100 m wide but, since there is no pillowed counterpart of this sequence on the southeast side of the anticline, the width is thought by the author not to represent the true thickness.

Flows here are mainly pillowed with good pillow shapes yielding abundant top-directions (northwest). Colour varies from pale green to greenish grey and grey on the fresh surface. Porphyritic (plagioclase) pillowed flows are common in a zone starting 1500 m north of Line Bay. Similar porphyritic flows were observed along strike in the same sequence of flows north of Line Bay as described in the Pipestone Lake (South) map-area (Edwards 1978).

Varioles are common in pillowed flows along the shoreline of Pipestone Lake but were seldom recognized inland and were not observed in mafic flows elsewhere in the southern block except for one isolated occurrence on the southeast shore of Sucan Lake. Amygdules, too, are common in this sequence and generally contain a mixture of quartz and calcite.

Elsewhere in the southern block porphyritic (plagioclase) flows in which phenocrysts seldom exceed 15 percent of the rock, occur in isolated zones. One zone of nebulous width trends roughly northeastward west of Furlonge Lake. Another zone is north of the west-central part of Furlonge Lake. Here the phenocrysts have been stretched subhorizontally by a factor of 4 or 5. Less deformed porphyritic flows occur east of Sucan Lake. Isolated zones of phenocrysts also are in mafic flows northwest and west-northwest of Lou Lake.

Many mafic flows along the entire zone of banded amphibolite and schists adjacent to the Jackfish Lake Complex contain plagioclase phenocrysts, usually stretched to some degree. The abundance of phenocrysts in many flows was observed in the same zone in the Pipestone Lake (South) area by Edwards (1978). A particularly prominent phenocryst-bearing zone trends northward through the central part of Bending Lady Lake adjacent to the Furlonge Lake Stock.

Amygdules are present in many of the mafic flows except those in the deformed zone adjacent to the Jackfish Lake Complex.

PYROCLASTIC ROCKS

Mafic pyroclastic rocks of variable but related nature lie stratigraphically between mafic flows and overlying metasediments. These rocks are well represented adjacent to the metasediments, west, south, and east of Thompson Bay and reach an apparent thickness of 610 m southwest of Thompson Bay where they are interbedded with amygdaloidal flows with quartz-filled amygdules up to 2 cm across. Similar amygdaloidal flows containing very few pillows extend as far southwest as Line Bay.

Mafic pyroclastic rocks are also below the metasediments of the Esox Lake area, but are less common and much thinner, being interbedded with or part of pillowed and massive flows. Such occurrences are along the north shore of the east part of Lou Lake.

In addition a vague zone approximately 210 m wide of mafic pyroclastic fragmental rocks similar to those in the vicinity of Thompson Bay is exposed discontinuously for a length of 1200 to 1500 m in what is interpreted to be a fold structure 915 m east of Sucan Lake. Sparse, apparently discontinuous remnants of contorted metasediments are also in this zone and may be infolded equivalents of the Thompson Bay metasediments.

Other zones of mafic pyroclastic rocks occur on the west side of the small lake 1500 m east of the southeast arm of Straw Lake. Here too they appear to be closely related stratigraphically to an infolded wedge of metasediments south of that lake.

Mafic tuff, lapilli-tuff, and tuff-breccia, partly interbedded with green-coloured tuffaceous wacke and metasediments, are exposed between Straw Lake and Sucan Lake.

Flow Breccia

Flow breccia is at two locations. These are: *a)* in a small outcrop 90 m southeast of the northwest tip of the large island between Thompson Bay and

Pipestone Lake, and *b)* in shoreline exposure midway along the north shore of Lou Lake. A third possible outcrop of this rock is in a much deformed shoreline exposure at the southwest tip of the same island as described above and would thus occupy a similar stratigraphic position on the south side of the Thompson Bay syncline.

At locations *a* and *b* above, the rock is beige- to pale green-weathering (pale greenish grey fresh surface) mafic flow which appears to have been brecciated in situ. The fragments are angular, generally fit together, and vary in size up to 10 cm in diameter. Some however are suspended in a dark grey matrix which in hand specimen resembles siltstone. Some fragments contain fractures which have been filled by matrix.

Hyaloclastic Breccia, Aguagene Tuff, Tuff, Lapilli-Tuff, and Tuff-Breccia

Hyaloclastic breccia mainly is associated with lapilli-tuff and/or tuff-breccia and less commonly with pillowed and vesicular flows.

Two excellent exposures exhibiting a mixed nature of these rocks occur *a)* on the north shore of the narrows in the south channel between Pipestone Lake and Thompson Bay, and *b)* on the shore of Thompson Bay south of the two small islands east of the south channel from Pipestone Lake.

At location *a*, greenish beige-weathering vesicular flow (possibly tuff) which has a pale green fresh surface contains brown subangular to angular clasts up to 6 cm in diameter, and larger pillow-like "blebby" clasts up to 0.4 m in diameter. Lighter coloured (beige) clasts are irregularly shaped, commonly vesicular, and have a brown reaction rim. Fragments amount to 70 percent of the rock in some zones but generally average 30 percent. Some zones up to 3 m thick have no fragments. In an adjacent outcrop to the north, is a similar rock which has predominantly the larger "blebby" rounded clasts which appear to have been fragments of flow or "almost formed" pillows caught in a moving flow (Photo 1).

At location *b*, a 1 m and a 3 m zone of hyaloclastic breccia is in what would otherwise be designated as agglomeratic tuff-breccia and lapilli-tuff. These zones are characterized by the presence of greenish beige angular, shardy fragments averaging less than 5 cm in diameter and which commonly have a brown reaction rim. Some fragments have a reaction rim missing on one or more sides. Many fragments contain amygdules averaging 2 to 3 mm in diameter. The matrix appears to be similar in both the breccia and the hyaloclastic breccia. It contains pinhead-sized amygdules, small shards, small (<1 mm) plagioclase phenocrysts, and may be aquagene tuff in part (Photo 2). The mafic agglomeratic tuff-breccia in the same outcrop has some angular fragments and some with tails (bomb-like) and less matrix than the hyaloclastic zones.

Pillow breccia associated with pillowed flow and hyaloclastic breccia occurs in a small outcrop 455 m southeast of the south tip of Thompson Bay. Layering in the outcrop trends roughly east-northeastward. The following is a description of a 5 m section across strike starting at the northern edge of the outcrop. A 1 m thick zone of small (less than 0.3 m across) poorly formed pillows is overlain by a 2 m thick zone consisting of a matrix of aquagene tuff (60 percent) contain-

OGS 10 426

Photo 1–Mafic flow breccia, south shore of the large island between Thompson Bay and Pipestone Lake. Rounded vesicular mafic fragments are surrounded by a mafic flow matrix and some zones resemble isolated pillows. Elsewhere in the same expoure, fragments are more angular and more numerous, resembling hyaloclastic breccia.

ing isolated selvaged pillows up to 0.3 m across and pillow fragments (pale greenish grey, commonly flow banded parallel to the rim) and 20 percent angular (shardy) fragments up to 6 cm across. Some of these fragments were rimmed by a brown alteration similar to that previously described. This zone is overlain by a 2 m thick pyroclastic zone containing 60 to 70 percent pillow and hyaloclastic fragments in a tuffaceous matrix.

The common occurrence of rocks of hyaloclastic affinities where good exposures allow a thorough examination of the outcrop suggests that much of this pyroclastic sequence may have more of this type of rock than is indicated on the map. In poorer exposures, many mafic rocks in which a fragmental nature is evident have been grouped as tuff-breccia or lapilli-tuff unless evidence to the contrary was observed.

Tuff-Breccia and Lapilli-Tuff

An exposure of tuff-breccia and lapilli-tuff occurs in a shoreline outcrop in the small bay in Pipestone Lake just south of the opening of the south channel

OGS 10 427

Photo 2–Mafic hyaloclastic breccia containing angular and shard-like fragments commonly with brown reaction rims, and a few amygdaloidal fragments. The matrix is tuff, small angular shards, pinhead-sized amygdules, and some small plagioclase phenocrysts. South shore of the west part of Thompson Bay.

into Thompson Bay. Here, amoeboid subround, rarely subangular greenish beige fragments up to 0.5 m in diameter lie in a darker green matrix. The fragments, which are commonly vesicular, average 4 cm in long dimension and exhibit a slight primary vertical elongation which is coincident with the plane of foliation. The matrix which appears to be partly flow and partly tuff and is commonly vesicular and porphyritic, comprises from 20 to 85 percent of the rock.

Throughout the rest of the sequence, tuff-breccia and lapilli-tuff are of a similar nature to that just described, varying only in the size and angularity of the fragments.

Petrography

In thin section, the mafic flows in general exhibit secondary mineralogy and relict primary textures. The mafic component is represented by 40 to 60 percent secondary tremolite or actinolite with various textures from fine, shreddy, felty, or nematoblastic replacement of the groundmass in fine-grained flows to coarse imperfect pseudomorphic replacement of primary clinopyroxene in the coarser grained flows.

Pale green to colourless chlorite is a less common alteration product associated with tremolite, and in rare instances forms the cores of tremolite pseudomorphs.

Plagioclase is for the most part altered to turbid epidote and/or clinozoisite, but may be saussurite and albite. Normally, the primary plagioclase texture is not obliterated and relict outlines of plagioclase laths can be distinguished in plane light. In one sample, poorly twinned subhedral to anhedral plagioclase exhibited little alteration to epidote. Although the Michel-Levy test could not be applied, plagioclase, here, appeared to be sodic in composition because of its positive sign and low extinction angle. In samples containing plagioclase phenocrysts, the phenocrysts are invariably completely saussuritized.

Other accessory minerals include: magnetite in trace amounts; leucoxene from trace to 8 percent; and pyrite from 0 to 5 percent.

Quartz, up to 5 percent, occurs as isolated anhedra, amygdule fillings associated with carbonate, epidote, or chlorite or rarely as very thin mantles of saussuritized relict plagioclase laths.

The mineral assemblage, tremolite + albite + epidote + chlorite + quartz as described above is consistent with that to be expected in mafic rocks metamorphosed to the greenschist facies.

INTERMEDIATE METAVOLCANICS

North of the Manitou Stretch-Pipestone Lake Fault

Most of the intermediate metavolcanics occur in the northern block. They form much of the core of the Yoke Lake Syncline overlying and partly interbedded with mafic flows at the margin of the synclinal structure. This particular sequence is mixed (mainly massive, porphyritic, and amygdaloidal) flows and pyroclastic rocks many of which show very little alteration or metamorphism. The pyroclastic rocks tend to be homolithic, with little evidence of redeposition. This criterion distinguishes them from most of the pyroclastic rocks observed by the author in the Kakagi Lake area to the west (Edwards 1980).

The intermediate sequence becomes sheared to the east through the northern part of Straw Lake. East of Straw Lake, sheared intermediate metavolcanics are intercalated with sheared felsic pyroclastic rocks and flows and minor mafic flows to the eastern boundary of the map-area and beyond.

Those intermediate metavolcanics in the sheared zone east of Straw Lake appear to be generally of the same nature as those at Yoke Lake being inter-


OGS 10 428

Photo 3–Pillowed amygdaloidal and porphyritic andesite flow, northern Yoke Lake. Here, each pillow is dotted with plagioclase laths (white) up to 3 mm in length. Thick selvages are common in the andesite flows in the vicinity of Yoke Lake but the amount of interstitial material varies. At this location, quartz and hyaloclastic fragments compose the interstices at the pillow junctions.

bedded flows and pyroclastic rocks. Therefore, the following description of intermediate metavolcanics in the vicinity of Yoke Lake can be extrapolated to include similar deformed rocks east of Straw Lake.

Some intermediate to mafic flows between Manitou Stretch and Missus Lake are similar to those at Yoke Lake. These have been grouped with the mafic flows and have already been discussed (see section "North of the Manitou Stretch-Pipestone Lake Fault" under "Mafic Metavolcanics").

FLOWS

A sequence of intermediate flows, discrete from the mafic flows, occurs at Yoke Lake and forms a part of the elliptical structure, the Yoke Lake Syncline. In the field they differ from the mafic flows in that they contain abundant lath-shaped plagioclase phenocrysts, 1 to 3 mm long and numerous irregularly shaped amygdules partially filled (mainly) with quartz and varying in size, up to 8 cm in diameter. Pillows where present are rotund with very thick (5 cm) selvages (Photos 3 and 4). Generally the flows are beige to grey on the weath-

Photo 4—Large quartz amygdule in andesite flow, northern Yoke Lake. Andesite flows in this vicinity are generally amygdaloidal containing up to 20 percent irregularly shaped quartz-filled amygdules up to 6.5 cm in diameter.

ered surface and greyish green on the fresh surface. The amygdules are in both pillowed and massive flows and are locally as much as 50 percent of the rock. In some pillows, amygdules are arranged concentrically inside the pillow, and in others, randomly distributed. No top-direction was determinable from amygdules at any location. As mentioned previously, pillows are generally quite round measuring an average of .75 to 1 m in diameter. Selvages weather considerably redder than the rest of the pillow. Selvage fragments rarely occur within the pillow. Pillow interstices are commonly quartz-filled and may contain brecciated selvage material. Where pillowed and with sufficient exposure, generally it is not difficult to determine tops in these flows.

In some exposures on Sullivan Lake, pillows are longer and narrower than typical for these flows (3 m by 1 m) and may be more akin to toe structure than pillows.

Many of the intermediate flows in the vicinity of Yoke Lake are fine to medium grained and massive but commonly have abundant amygdules. A few of the units mapped as flows because of the lack of contrast between fragments and matrix may be in part pyroclastic.

OGS 10 430

Photo 5–Intermediate agglomeratic tuff-breccia, northern Yoke Lake near the creek from Crossroute Lake. Most fragments are more felsic than the matrix. Some exhibit flow banding.

PYROCLASTIC ROCKS

Intercalated with intermediate flows at Yoke Lake are numerous lenses and zones of pyroclastic rocks varying in grain size from tuff and crystal tuff to tuff-breccia. The majority by far are lapilli-tuff and tuff-breccia, which commonly have crystal tuff matrices.

Yoke Lake

TUFF-BRECCIA AND AGGLOMERATIC TUFF-BRECCIA The east-trending heterolithic, agglomeratic tuff-breccia and lapilli-tuff exposed along the shoreline of the east bay of the north arm of Yoke Lake are more or less typical of the tuff-breccia found in the Yoke Lake area. Here 5 to 10 percent of the breccia-sized clasts are roughly bomb-shaped. The remainder of the clasts range from subrounded to angular shapes and accounted for 75 percent of the rock (Photo 5). Many clasts are felsic, commonly displaying flow banding, and weather light grey to beige. Intermediate composition fragments are commonly porphyritic (plagioclase) and their matrix weathers green to a rusty grey colour and is probably intermediate in composition. Fragment size diminishes southeastward in this exposure. Felsic tuff-breccia and lapilli-tuff are in contact with this unit to the south.

In the same sequence 610 m to the east, fragments are more angular in shape and bomb-shaped clasts are absent. Fragment sizes here also diminish southward.

LAPILLI-TUFF, CRYSTAL TUFF, AND TUFF In general, gradation from tuff-breccia to lapilli-tuff is common and much of the lapilli-tuff in the areas around the north and northeast arms of Yoke Lake resembles the tuff-breccia already described except for a smaller clast size.

Crystal lapilli-tuff, lesser crystal tuff-breccia, and bedded crystal tuff along the south shore of Yoke Lake have 20 percent plagioclase crystals. This rock is typically greenish grey on the weathered surface with a light grey fresh surface. Commonly the plagioclase crystals are dark and transparent with albite, and Carlsbad twins being visible to the naked eye. Locally, beds usually greater than 1 m thick are in the crystal tuff or lapilli-tuff.

Two hundred and ten metres due east of the southern tip of the small lake between Yoke Lake and Crossroute Lake is an outcrop 15 m across, the northern half of which consists of tuff-breccia similar to that previously described. The southern half is a beige to light brown weathering homolithic lapilli-tuff. Here, vesiculated fragments are somewhat elongate, are slightly darker in colour than the matrix, and contain abundant plagioclase phenocrysts (as does the matrix). This rock is a possible ignimbrite. A similar rock is exposed 455 m east of the centre of the arm of Yoke Lake leading to its northwest bay.

A prominent semi-continuous unit of bedded tuff, and crystal tuff interbedded with lapilli-tuff follows the synclinal structure just north of the southern part of Yoke Lake. Crystal tuff containing rare lapilli fragments forms beds up to 1 m thick. The tuff is massive to finely laminated, weathers light beige and commonly consists of interbedded coarse and fine units. Where overlain by crystal tuff as in shoreline exposure in the small bay on the west side and south of the narrowest part of channel into the northeast arm of Yoke Lake, flame structures and load casts were formed.

Bluffpoint Lake

Intermediate metavolcanics in the vicinity of the southern part of Bluffpoint Lake differ from the typical metavolcanics at Yoke Lake in that they are generally lighter coloured, appear more siliceous and are more commonly homolithic (with very little matrix) than heterolithic. In some pyroclastic rocks, fragments are barely discernible from matrix.

Rocks exposed along the shore of the large north-trending peninsula at the south end of Bluffpoint Lake commonly have grey to greenish grey angular fragments in a light coloured matrix. In some exposures, the rock appears to have been brecciated in situ. At the northwest tip of the peninsula a light grey massive rock, containing zones of spherules up to 3 mm in diameter, is partly brecciated. The nature of the brecciation suggests that some very large fragments, not discernible in an exposure, may be present in the vicinity.

This sequence is interpreted to be vent facies consisting of brecciated flow and possibly explosion or collapse breccia.

South of the Manitou Stretch-Pipestone Lake Fault

Intermediate metavolcanics are uncommon in the southern block. Tuff, lapilli-tuff, tuff-breccia, and minor flows are associated with felsic pyroclastic rocks and flows and conglomerate with associated metasediments (possibly arenite) in a north-northeast-trending zone up to 520 m wide southwest of Thompson Bay. The stratigraphic position of this zone is uncertain but it appears to be coincident with the axis of the Thompson Bay anticline below the mafic pyroclastic rocks which underlie the metasediments at Thompson Bay. A similar zone of rocks (but lacking the conglomerate) occupies a similar stratigraphic position southeast of Thompson Bay.

Minor isolated intermediate pyroclastic rocks are south of the quartz-feldspar porphyry stock southwest of Sucan Lake, north of Sucan Lake interbedded with felsic and mafic pyroclastic rocks and adjacent to mafic pyroclastic rocks and metasediments midway between the southeast arm of Straw Lake and Manitou Stretch.

Petrography

In thin section, the fine-grained intermediate flows in the Yoke Lake area exhibit pilotaxitic texture in which seriate porphyritic (commonly glomerophyric) sodic plagioclase laths form a felted texture intergrown with fine, fibrous tremolite. Turbid, very fine grained epidote is also present interstitially. The following mineral components typify this type of flow: plagioclase in groundmass 55 to 70 percent; plagioclase phenocrysts, up to 20 percent; tremolite, 15 to 20 percent; turbid epidote, 5 to 15 percent; chlorite, trace to 5 percent; sericite, trace amounts after plagioclase.

Amygdules, where present, are filled with radiating quartz which have pockets of radiating acicular masses of pale green epidote and carbonate.

One sample of brown-weathering pillow selvage from a flow on a small island in the north arm of Yoke Lake 600 m southwest of the creek into Crossroute Lake, consists of 90 percent turbid, brown epidote. Perlitic cracks are still evident in the epidotized groundmass suggesting the rim was glassy at one time. Plagioclase phenocrysts have been totally altered, some primarily to quartz but some to an albite, saussurite, chlorite, and quartz mixture.

An anhedral, brown (stained?), uniaxial positive mineral forming 10 percent of the sample was not identified by the author. This mineral tends to form in the perlitic crack, along the margins of altered plagioclase phenocrysts, adjacent to amygdules and rarely netted within the epidotized groundmass.

Pyroclastic rocks from the Yoke Lake area examined in thin section show remarkable preservation and generally consist of a mineral assemblage similar to the flows. Fragments in the lapilli-tuff samples studied vary in internal grain size but commonly exhibited porphyritic to glomerophyric (plagioclase), pilotaxitic texture with various degrees of fluxion manifested in plagioclase microlites. Tremolite phenocrysts are not uncommon and both sodic plagioclase and tremolite phenocrysts form much of the groundmass as broken to whole, seriate-sized clasts. Amygdules are in some of the clasts, and are commonly filled with quartz rarely accompanied by epidote or chlorite, and are generally surrounded by an alteration halo of turbid epidote. Epidote also is an alteration product of, or addition, to the interstitial tuff and rarely is partial alteration product of groundmass in the lapilli fragments. Rarely, chlorite is a pseudomorph of a stumpy prismatic mineral, possibly pyroxene in both the fragments and the interstitial tuff, or is associated with epidote as an alteration of the interstitial material.

In the lapilli-tuff studied, interstitial tuff accounted for less than 30 percent of the rock in each sample. No evidence for welding was observed in any of the samples.

A thin section of very well preserved bedded crystal tuff located on the south shore of the central part of the northeast arm of Yoke Lake has the following assemblage: 55 percent sodic plagioclase as angular broken and bent clasts in all sizes up to 1 mm and as microlites in lithic fragments; 15 percent anhedral to prismatic and fibrous tremolite as phenocrysts; 10 percent lithic fragments, generally fine grained and exhibiting pilotaxitic texture; 10 percent chlorite replacing tremolite and possibly other mafic phenocryst species; 15 percent groundmass of very fine grained plagioclase and tremolite; 5 percent leucoxene; and 5 percent sericite and epidote as minor groundmass alteration.

FELSIC METAVOLCANICS

Minor tuff-breccia units are intercalated with intermediate pyroclastic rocks in the Yoke Lake vicinity. Most of the felsic metavolcanics are east of Straw Lake. Those in the vicinity of the Straw Lake Beach Mine have been described by Thompson (1936). These are mainly sheared light beige to yellowish lapilli-tuff. A roughly oval-shaped zone of what appears to be felsic flow(s) is south of the mine. Similar sheared felsic metavolcanics intercalated with intermediate and mafic metavolcanics extend eastward and beyond the map-area. Some of the felsic subvolcanic porphyry lenses and sheets west of Mister Lake could be felsic flows or domes.

North of the Manitou Stretch-Pipestone Lake Fault

Minor discontinuous units usually less than 100 m thick of felsic metavolcanics are interbedded with intermediate and some mafic metavolcanics north and west of Straw Lake in the Yoke Lake structure. The majority of the felsic metavolcanics in the map-area are exposed between Straw Lake and the eastern boundary of the map-area between Manitou Stretch and Missus Lake. They have been subjected for the most part, to a strong deformation resulting in the formation of sericite schist which obscures the original texture in many exposures (see section "Structural Geology"). In some outcrops, it is difficult to decide whether the fragmental nature of some of these rocks is a primary or secondary one induced by differential shear. Many of the sheared felsic metavolcanics in the eastern part of the map-area are grouped as sericite schist by the author since the primary nature of the rock is obscure in most of the outcrops.

FLOWS

Grey- to beige-weathering (light grey fresh surface) felsic flow exhibiting faint, brecciated, fluxion texture occurs 60 m east of the central east shore of the small lake between the north arm of Yoke Lake and Sullivan Lake. Sparse quartz 'eyes' less than 1 mm in diameter may be phenocrysts or small amygdules. Chemical analysis (Geoscience Laboratories, Ontario Geological Survey) confirms that this rock is rhyolite containing 77.5 percent SiO_2. Felsic lapilli-tuff and tuff-breccia are along strike to the west-southwest of this outcrop and forms a continuous traceable felsic zone over 610 m long.

A 1350 m long, 150 m wide roughly elliptical shaped body of white- to pale beige-weathering felsic flow is exposed 300 m south of the northeast arm of Straw Lake just south of the Straw Lake Beach Mine site. This rock is distinctive from the adjacent pyroclastic rocks in that an east-trending fracture cleavage rather than schistosity is developed. The fresh surface is yellowish beige and sericitic with no mafic minerals visible. No quartz or feldspar phenocrysts or amygdules were observed in the outcrops.

A narrow exposure of a more massive but similar rock occurs along the central part of south shore of the northeast arm of Straw Lake. East from these occurrences some schistose felsic rocks bearing no evidence of fragments are mapped as flows. West-southwest of Mister Lake much of the sericite schist has feldspar and less commonly quartz phenocrysts and commonly has a pinkish hue. The schist is interpreted by the author as subvolcanic felsic porphyry sheets but could be flows, domes, or at least the source feeders for the flows.

Minor massive felsic rocks occur with a felsic pyroclastic unit south of Mister Lake and north of Manitou Stretch. Phenocrysts and amygdules are not in any exposure seen by the author but the close association with pyroclastic rocks suggests that they are probably flows.

LAPILLI-TUFF AND TUFF-BRECCIA

Minor lenses of felsic lapilli-tuff and tuff-breccia are interbedded with intermediate and mafic metavolcanics in the vicinity of Yoke Lake. They resemble similar rocks of intermediate composition described earlier, differing only in composition and tending to be homolithic. In one outcrop of mainly white-weathering tuff-breccia on the west shore of the northeast arm of Yoke Lake several of the fragments weathered brown with a peculiar sort of concentric zoning. These possibly represent devitrified obsidian fragments.

Lapilli-tuff is common east of Straw Lake and is well represented on the mainland due east of the largest island in Straw Lake. Here, a unit (or units) of lapilli-tuff attains a thickness of close to 300 m and sheared, similar rock is traceable for 2400 m eastward. Typically the rock weathers beige to brownish beige and has a sericite yellowish beige fresh surface. The matrix, which is sericite schist, accounts for less than 30 percent of the rock in most samples. Commonly the fragments are roughly equal in size. There is no evidence of any phenocrysts.

As mentioned previously, the deformation in some outcrops is such that the pyroclastic rock could have been formed by differential shear. The previously described presumably homogeneous, felsic flow south of the Straw Lake Beach Mine site was cleaved rather than fragmented by deformation. This phenomenon suggests to the author that those deformed rocks which appear to be pyroclastic are for the most part homolithic primary fragmental rocks and that the schistosity only emphasizes their pyroclastic nature.

Several outcrops south of the northeast arm of Straw Lake (south of the Straw Lake Beach Mine site) contain fragments large enough to be considered breccia (or agglomerate). Some fragments are over 1 m long and .5 m wide. They are tightly packed with a small amount of sericitic matrix and are stretched in the plane of schistosity. It is uncertain whether this is a pyroclastic texture.

Certainly good pyroclastic (tuff) breccia does occur in this zone, and where it does, it resembles the lapilli-tuff except for the size of the clasts. An excellent example of homolithic lapilli-tuff and tuff-breccia is interbedded with felsite (felsic flows?) and mafic flow 120 m northeast of the small lake north of Manitou Stretch, 180 m west of the eastern boundary of the map-area.

South of the Manitou Stretch-Pipestone Lake Fault

Felsic extrusive metavolcanics are uncommon in the southern block being restricted to the western part of the map-area. Lapilli-tuff, tuff, and minor flow are interbedded with intermediate and mafic metavolcanics and conglomerate and other metasediments in two narrow south-southeast-trending lenticular belts; one southwest of Thompson Bay and one southeast of Thompson Bay. The belt to the southwest of Thompson Bay lies stratigraphically below the mafic pyroclastic rocks (which underlie the Thompson Bay metasediments) and also below the mafic flows southwest of Thompson Bay. This may put them at the core of the Thompson Bay antiform. The belt southeast of Thompson Bay occupies a similar stratigraphic position but no anticline was identified by the author.

The felsic lapilli-tuff at these locations is similar to that described for the northern block except that in part it is gradational with intermediate pyroclastic rocks. A sericitic, white-weathering, cherty textured felsic flow occurs 610 m northeast of the northern part of Line Bay. This flow appears to be pyroclastic in part and is partly overlain and underlain by metasediments.

A 150 m wide unit of almost white homolithic massive tuff and lapilli-tuff trends roughly northward along the western edge of the basic stock at Sucan

Lake. Lapilli fragments are present in some zones and are difficult to discern because of the homogeneous composition of the rock. Minor lenses of felsic tuff and lapilli-tuff and tuff-breccia are along the southeast contact of and are septa in the basic stock.

There is a brecciated amygdaloidal felsic flow 240 m southeast of the narrows of Sucan Lake in a northeast-trending 60 m wide zone of felsic flow and lapilli-tuff. Flow banding around quartz amygdules is present here and the flow contains what appears to be selvage fragments.

Between Sucan Lake and Straw Lake, minor felsic metavolcanics are represented mainly by carbonatized sericite schist interbedded with intermediate lapilli-tuff and mafic pyroclastic rocks. The stratigraphic position of these rocks appears to be that of the previously described belts of intermediate and felsic metavolcanics southeast and southwest of Thompson Bay. This is indicated by their spatial relationship with mafic pyroclastic rocks and metasediments.

Petrography

There is little difference observed in thin section between felsic pyroclastic samples and massive flow samples, in terms of mineralogy. Both pyroclastic rocks and flows contain from 5 to 40 percent partly sericitized sodic plagioclase phenocrysts ranging in size from groundmass to 3 mm. Generally, quartz phenocrysts are anhedral, less common, and smaller than the plagioclase phenocrysts (less than 2 mm) and range from less than 1 to 20 percent of the specimens observed. In one sample of felsic flow taken 230 m south of Mister Lake, 1170 m west of the eastern boundary of the map-area, quartz phenocrysts up to 2 mm in diameter exhibit varying degrees of embayment but also commonly display euhedral outlines.

Groundmass in both the flows and the pyroclasts is fine grained, recrystallized, and quartzofeldspathic, with varying degrees of alteration to sericite. Other secondary minerals include pyrite (trace to 8 percent), carbonate, and rarely chlorite, in the vicinity of pyrite.

Two thin sections of pyroclastic rocks taken south of Straw Lake in the area of the Straw Lake Beach Mine differ from the massive flows in that fragments are separated from each other by anastomosing, streaky masses of lepidoblastic, very fine grained sericite which results in a flaser-like structure and which may have obliterated the primary pyroclastic texture. From thin section evidence, however, it would be difficult to conclude irrefutably that the samples observed are true pyroclastic rocks.

CLASTIC METASEDIMENTS

Most of the metasediments in the map-area occupy a synclinal core position lying stratigraphically above all other rocks; none occur north of the Manitou Stretch-Pipestone Lake Fault.

A regional correlation of the metasediments is presented by Thomson

(1936, p.16, 17), who, having seen the sedimentary rocks exposed from Stormy Lake through to Schistose Lake, states "The Upper Manitou and Stormy lakes sediments are characterized by the presence of a large amount of boulder conglomerate, in sharp contrast to the paucity of this rock in the Esox-Pipestone-Schistose lakes areas. With this exception there is no outstanding difference in the lithology of these separate bands of metasediments". This statement certainly holds true for those metasediments in the Esox-Pipestone-Schistose Lakes area.

Small bands of metasediments are separate from the major synclines at Thompson Bay and Esox Lake but they are interpreted to be infolded remnants of the same series. This interpretation does not apply to those metasediments, including conglomerate, which are with the two belts of felsic and intermediate metavolcanics southeast and southwest of Thompson Bay which will be described separately.

Generally, the texture of the metasediments is diverse in nature, ranging from unbedded, poorly sorted, granular and rarely pebbly, arkosic wacke or tuffaceous wacke similar to those along the north shore of Schistose Lake (Edwards 1980) to finely laminated siltstone and mudstone. Structures or lack of structures in these rocks also indicate a variety of depositional environments. These range from siltstone-dominated partial Bouma sequences to rapidly deposited unsorted, coarser grained wacke units with vague or no bedding.

Graded beds, cross laminations, flame structures, load casts, disrupted bedding, rip-up clasts, and wacke dikes are present at various locations, especially in the Thompson Bay area (Photos 6, 7, 8, 9).

Typically, arkosic wacke weathers beige to greenish beige and has a grey to greenish grey fresh surface. Siltstone and mudstone weather grey, rarely greenish grey, and are darker grey on the fresh surface. Together with minor tuffaceous and conglomerate interbeds these two rocks form the dominant part of the Thompson Bay and Esox Lake metasediments.

Siltstone and Mudstone

Siltstone (and mudstone) is present to some degree interbedded with coarser metasediments in most exposures except in metasediments north of Seahorse Lake. In some outcrops it is conspicuously predominant and forms thin (average less than 5 cm) commonly laminated beds interbedded with fine or medium wacke of varying thicknesses. These areas are *a)* the general area south of Thompson Bay, *b)* in a few small outcrops near the mouth of Sucan Creek in the northern part of Sucan Lake, and *c)* some of the easternmost islands in the northern part of Esox Lake near the entrance to Canoe Bay.

Fine to Coarse Wacke (Sandstone)

Fine and medium wacke predominates elsewhere in the map-area and generally is thick- to thin-bedded, not uncommonly laminated, and interbedded with siltstone or mudstone (except north of Seahorse Lake). The thicker units

OGS 10 431

Photo 6–Flame structures formed by loading of siltstone beneath a graded wacke, 400 m east of Thompson Bay, 250 m south of Pipestone Creek.

are rarely graded and most of the thinner units are not graded except in thin-bedded turbidites described below.

Coarse to rarely granular, poorly bedded to massive wacke having sparse, white aphanitic pebbles is common north of Seahorse Lake and in some shoreline exposures on the north shore of Manitou Stretch, west of Manitou Rapids. Metasediments in the Thompson Bay area, south of Pipestone Creek, are similar but are more commonly bedded, and siltstone (mudstone) is generally more abundant.

Quartz granule-rich horizons of variable width, less than 10 cm, having up to 80 percent quartz, occur on the south shore of the point on the west side of Thompson Bay, due west of Pipestone Creek.

Conglomerate

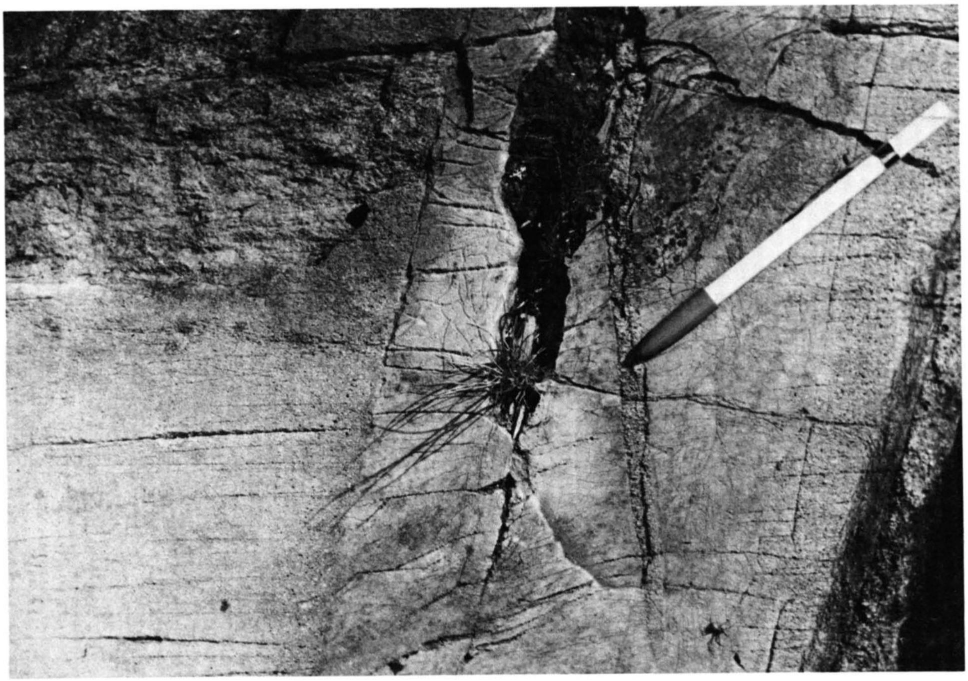
In the Thompson Bay and Esox Lake metasediments true pebble conglomerate is present at only one location, 300 m east of Thompson Bay about 610 m south of Pipestone Creek. This rock has a closed framework of less than 10 per-

OGS 10 432

Photo 7–Penecontemporaneous soft sediment deformation of pebbly wacke and mudstone, west shore, Thompson Bay.

cent matrix. The clasts are subrounded to subangular and appear to be mainly pebbles of grey siltstone and beige wacke. The width of the unit was not determined because of the nature of the exposure.

Conglomeratic horizons bearing white aphanitic subangular to subrounded pebbles are not uncommon in the coarser wacke (sandstone). Notably these are on the northwest shore of Thompson Bay; the southwest shore of Thompson Bay; 1050 m north-northeast of Seahorse Lake; and in some shoreline exposures along the south shore of Manitou Stretch, west of Manitou Rapids.



OGS 10 433

Photo 8–Autointrusive wacke dike transecting siltstone unit in interbedded siltstone and wacke, 300 m east of Thompson Bay, 470 m south of the mouth of Pipestone Creek.

Turbidites

Many of the finer grained, interbedded wacke and siltstone, especially those in the Thompson Bay area, exhibit evidence of having been deposited by turbidity currents. The best exposure in the map-area is on the small island at the mouth of Pipestone Creek in Thompson Bay which almost completely consists of interbedded fine and very fine wacke and siltstone (mudstone).

As a rule the wacke beds are graded and are topped with a thinner horizon of laminated, very fine wacke. A crossbedded horizon of very fine wacke overlies the laminated very fine wacke at one location on the island. In the remainder of the outcrop, varying thicknesses of massive, rarely laminated siltstone or mudstone overlie the laminated very fine wacke. These features compare with Bouma divisions A,B,C, and E described by A.H. Bouma (1962). The thickness of complete Bouma sequences in this outcrop ranged from less than 1 to 7 cm.

OGS 10 434

Photo 9–Penecontemporaneous soft sediment deformation of cherty mudstone in a coarse-grained wacke unit, southwest shore of the large island between Thompson Bay and Pipestone Lake. Deformation of the mudstone probably resulted from fluidization of the coarser wacke.

Tuffaceous Metasediments

Some poorly sorted, poorly bedded to massive and conglomeratic horizons are exposed on the two small islands in the northwestern part of Thompson Bay and again along the north and northeast shore of the point on the west side of Thompson Bay (opposite Pipestone Creek) and in some shoreline exposures along the southeast shore of the large island at the western entrance of Thompson Bay. These are probably redeposited felsic to intermediate volcanic rocks, though they are commonly interbedded with thinner turbidite-like units. These redeposited volcanic fragmental zones are similar to those described by Edwards (1980) along the north shore of Schistose Lake, especially in some outcrops at the northwest end of the lake in which isolated volcanic lapilli- to breccia-size fragments are suspended in a poorly sorted, fine to very coarse grained matrix.

Straw Lake Area

Green Tuffwacke

Some pale green metasediments are called green tuffwacke by the author because they are poorly sorted, though bedded and because at Sucan Lake (north shore, central part) they are spatially associated with mafic tuff. Green tuffwacke also occurs in one outcrop along the east shore of Thompson Bay north of Pipestone Creek, in one outcrop on Pipestone Creek 610 m east of Thompson Bay, and in numerous outcrops along the north shore of Sucan Lake. Some of the infolded metasediments which extend east and south from the small lake 1500 m east of the southeast arm of Straw Lake and the narrow band of metasediments which are on the peninsulas in the north part of Furlonge Lake are also tuffwacke.

The green colour in some of these rocks may be the result of having been locally derived from weathering of underlying mafic volcanic rocks.

Petrography

The following primary assemblages are present in the ten wacke samples studied in thin section.

plagioclase clasts, 55-70 percent
quartz clasts, 0-15 percent
lithic clasts, 0-5 percent
matrix, 15-25 percent
amphibole clasts, 0-10 percent
zircon, traces
apatite, traces
sphene, traces

The high percentage of matrix and the preponderance of plagioclase clasts categorize the samples examined as arkosic wacke using the classification as devised by G.M. Young (1967) and now adopted by the Ontario Geological Survey (Wood 1975, Fig. 2, p.19). These few samples however may not be representative of the metasediments at Thompson Bay and Esox Lake because of the diverse nature of these rocks.

The high matrix content coupled with the high percentage of plagioclase and paucity of quartz clasts implies a local, probably volcanic source. The presence of tuffaceous rocks in parts of Thompson Bay (especially the western part) supports the idea of a proximal source. The finer, more distal facies Bouma sequences elsewhere in the Thompson Bay area could have been deposited during waning stages of cyclic volcanic activity. Metasediments in the Esox Lake area especially south of Manitou Stretch however are generally finer grained siltstone and mudstone and may be a more distal facies.

Features in the metasediments in the area, especially those at Thompson Bay, are similar to those in the Schistose and Pipestone Lakes area as discussed by Edwards (1980).

CHEMICAL METASEDIMENTS

Iron Formation

Two outcrops of massive pyrite (with pyrrhotite) occur in shoreline exposure on Furlonge Lake, one at the extreme southwestern part of the lake, and the other 425 m southwest of the entrance to the portage leading to Sucan Lake. Pyrite fills some of the interstices between fragments in mafic tuff-breccia in the shoreline exposure north of the small peninsula along the north-central shore of Furlonge Lake, and in what appears to be mafic flow breccia in shoreline exposure 700 m east of the southwest corner of the lake. Several outcrops along the shoreline of the southwestern part of Furlonge Lake are iron stained and contain stringers and blebs of pyrite accounting for up to 15 percent of the rock in some outcrops.

The pyrite-pyrrhotite-rich zone appears to be roughly east-northeast-trending and semi-continuous with similar zones occurring in the area south of Pipestone Lake (Edwards 1978).

Chert and Ferruginous Chert

A zone of bedded, iron-stained ferruginous chert is in poor exposure associated with an inclusion of mafic tuff or flow in a composite mafic to ultramafic sill 2400 m east of Line Bay. The exposure is such that only the minimum width of .5 m for the unit could be determined.

Banded chert and associated gossan up to 2 m wide is interbedded with a pillowed mafic flow 275 m northeast of the small lake west of the south arm of Sucan Lake.

Metamorphosed Mafic and Ultramafic Intrusive Rocks

NORTH OF THE MANITOU STRETCH-PIPESTONE LAKE FAULT

Metamorphosed mafic intrusive rocks are of minor importance north of the Manitou Stretch-Pipestone Lake Fault and only a brief description is given here.

Leucocratic Gabbro

A roughly north-trending dike of light greenish beige-weathering (speckled light and dark green fresh surface) leucocratic gabbro outcrops on the east shore of the southwestern part of Yoke Lake. This unit is traceable for 520 m along strike and has a minimum width of 120 m.

Quartz-Amphibole Gabbro

One outcrop measuring 150 m by 60 m of this rock occurs along the west shore of the northeast arm of Yoke Lake. In hand specimen the rock is green, has 40 percent mafic minerals (primarily amphibole), 50 percent recrystallized plagioclase, and 10 percent bluish quartz 'eyes'.

Peridotite

A 30 m wide by 150 m long sill-like body of green to reddish brown-weathering serpentinized peridotite trends roughly east-northeast from the northeast tip of the northwest arm of Yoke Lake apparently intruding mafic flows. In hand specimen, serpentine pseudomorphs after olivine up to 3 mm in diameter are set in a finer green to black matrix and comprise up to 75 percent of the rock.

SOUTH OF THE MANITOU STRETCH-PIPESTONE LAKE FAULT

Line Bay to Sucan Lake

Composite, lenticular, apparently semi-continuous mafic to ultramafic sills with an apparent thickness of 455 m intrude mafic flows in an east-northeast-trending zone between Line Bay and Sucan Lake. The zone extends west of the present map-area south of Pipestone Lake into the Pipestone Lake (South) map-area[1] (Edwards 1978).

South of Sucan Lake, a roughly crescent-shaped stock-like composite mafic to ultramafic body intrudes mafic flows and felsic tuff and lapilli-tuff. This intrusion appears to be a folded, thick, possibly layered, sill or lopolith.

These intrusions are similar to those which have been previously described by Edwards (1978) in much of the Pipestone Lake (South) map-area to the west. They consist of altered peridotite (talcose, serpentinized peridotite), medium- to coarse-grained gabbro, (quartz) amphibole gabbro, leucocratic gabbro, and possibly gabbroic anorthosite. Medium- to coarse-grained gabbro is more common in these intrusions than in the intrusions at Pipestone Lake. As in the Pipestone Lake (South) area, there is no direct evidence to suggest that in situ crystal settling is responsible for the layering.

[1]Pipestone Lake (South) area has been renamed Bethune Lake area.

East of Furlonge and Bending Lady Lakes

A stock-like composite body consisting of medium- to coarse-grained gabbro, ophitic gabbro, porphyritic (plagioclase) gabbro and subordinate magnetite-bearing (quartz) amphibole gabbro, and minor peridotite (as talc schist) intrudes mafic flows in this area. The talc schist is at the west end of Furlónge Lake (south shore) as a narrow band of unknown width right on the shoreline. Between Seahorse Lake and the small lake east-northeast of Furlonge Lake, three east-northeast-trending sills of green-weathering medium-grained gabbro intrude mafic flows.

Felsic, Intermediate, and Mafic Intrusive Rocks

SUBVOLCANIC ROCKS

Metamorphosed biotite, amphibolite (chlorite), quartz and feldspar porphyry, felsite and minor leucocratic biotite trondhjemite sheets, dikes, and stocks intrude mainly the lower mafic metavolcanics both north and south of the Manitou Stretch-Pipestone Lake Fault.

North of the Manitou Stretch-Pipestone Lake Fault

Felsic quartz and quartz-feldspar porphyry and rarer felsite sheets up to 60 m thick intrude mafic and intermediate metavolcanics in the vicinity of and particularly northwest of Yoke Lake. Where visible, the contact with the host rock is commonly well foliated and darker in colour than normal for the host rock due to the development of chlorite. One felsite dike on the the northwest arm of Yoke Lake south of Crossroute Lake contains sparse stringers rich in arsenopyrite (see section "Suggestions for Exploration" under "Economic Geology").

West of Mister Lake, pale yellow to pinkish-weathering, sheared quartz-feldspar and feldspar porphyry sheets and lenses which may be tectonically flattened domes appear to merge with felsic metavolcanics south of the northeast arm of Straw Lake.

South of the Manitou Stretch-Pipestone Lake Fault

STOCKS

Three separate porphyry stocks intrude mainly mafic flows in the southern part of the map-area; one is 1000 m southwest of Sucan Lake and the other two are at Esox Lake.

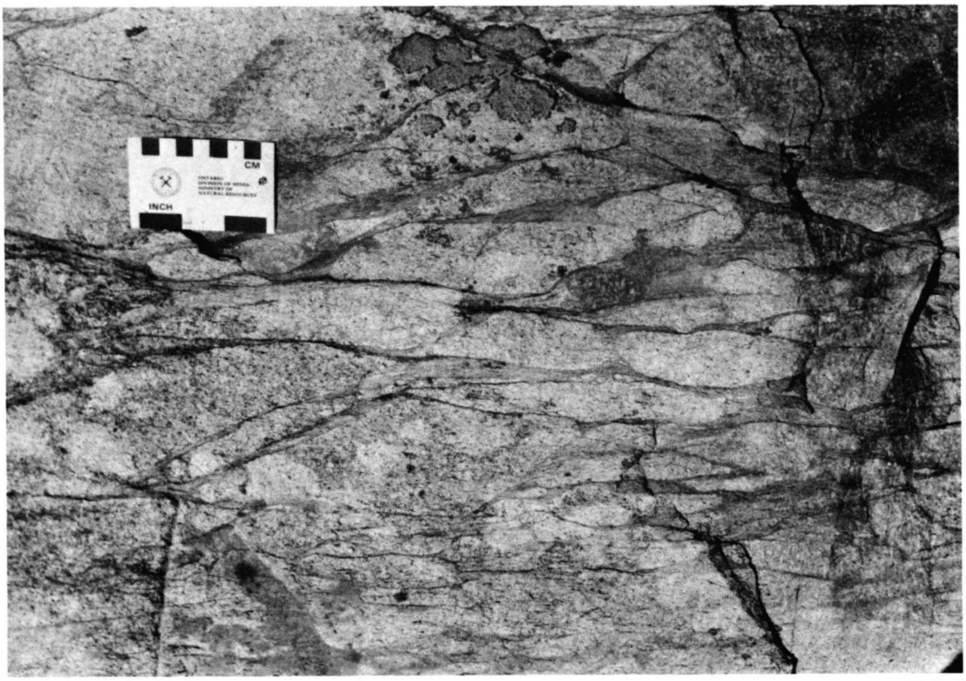
OGS 10 435

Photo 10–Fragmented, autoclastic(?) quartz-feldspar porphyry, south shore, Seahorse Lake.

Southwest of Sucan Lake, the predominantly quartz-feldspar porphyry stock apparently postdates the basic intrusion at Sucan Lake. Some areas within the stock are fragmental and may be related to the emplacement of the body.

At Esox Lake, two porphyry stocks were identified. The northern one extends from Seahorse Lake, eastward south of the Esox Lake Stock and across Esox Lake to the east shore (in the map-area). This stock which is mainly (biotite) quartz-feldspar porphyry is fragmented throughout most of its length. The fragmentation is variable from partial to complete. At Seahorse Lake, fragmentation is complete (Photo 10). The matrix is generally fine-grained porphyry near the western contact with the mafic flows in a zone where mafic inclusions are common and the matrix is distinctly darker in colour because of a higher percentage of biotite.

On the east shore of Esox Lake (in the map-area) some areas of the stock have been brecciated, taking on a character distinct from the rest of the stock. Here, the rock is partially to completely brecciated forming angular, closely packed fragments with a distinctive dark grey argillite-like matrix consisting of fine-grained quartz and plagioclase with minor, minute flakes of biotite and muscovite.



OGS 10 436

Photo 11–Autoclastic(?) fragmented quartz-feldspar porphyry. Here, incomplete fragmentation has taken place and larger masses of quartz-feldspar porphyry remain intact. West shore of central Esox Lake, west of the large island.

Farther south, on the west shore of Esox Lake, the matrix is the same composition as the fragments, differing only in that it is more schistose. The matrix schistosity and fragments are aligned parallel to the regional foliation in the vicinity and though the rock resembles homogeneous lapillistone or pyroclastic breccia in some zones (Photo 11) the texture more likely results from differential shear in a homogeneous body, resulting in flaser structure.

In general, the overall structure of this body can be interpreted as autoclastic, resulting from autobrecciation during intrusion. This interpretation can be applied because of the lack of evidence for extrusive volcanic activity in areas adjacent to the body. Some of the observed fragmentation may be a product of the unroofing (possibly contemporaneous) of a subvolcanic stock or dome. Evidence to support this theory is present east of the map-area on an island in the northeast bay of Esox Lake where porphyry clast-bearing polymictic conglomerate occurs near the projected contact between metasediments and the stock.

The southern (biotite)-quartz-feldspar porphyry stock is commonly strongly schistose and appears to be folded (unknown plunge) about mafic metavolcanics east of Esox Lake. That this stock is located within the exocontact zone of strong deformation of the Jackfish Lake Complex accounts for the pinch-and-swell structures (see Photo 13), mylonite, and flaser structure.

In thin section, the Esox Lake porphyry stocks exhibit the following mineral ranges: quartz as strained polyhedral phenocrysts less than 3 mm across and rarely rimmed by biotite, 7 to 20 percent; subhedral albite phenocrysts less than 3 mm across, partly to almost completely sericitized, displaying rare zoning, 13 to 30 percent; microcline phenocrysts and glomerocrysts, generally 1 to 2 mm in diameter, subhedral, slightly altered to clay, may partially replace albite phenocrysts, up to 10 percent; pale greenish brown to colourless biotite (phlogopite?) in trace amounts to 10 percent and occurring as isolated, 1 mm flakes or aggregates in groundmass and rarely in rims of quartz and plagioclase phenocrysts or pyrite. Sericite occurs as partial to almost complete replacement of albite and as minute flakes in the groundmass; epidote occurs as isolated grains and clumps as a groundmass alteration or replacement in amounts up to 5 percent and rarely as albite phenocryst replacement or associated with pyrite; pyrite is present in most specimens in trace amounts but rarely in amounts up to 5 percent. The groundmass is mainly fine-grained quartz and feldspar (approximately .03 mm) with sutured grain boundaries.

DIKES

A swarm of felsic dikes similar to those described northwest of Yoke Lake intrudes mafic metavolcanics east of Sucan Lake. These dikes are mainly recrystallized and their porphyritic nature is not evident in hand specimen.

A thin section of a sample taken from the southern end of the small lake south of the southeast arm of Straw Lake has 25 percent plagioclase phenocrysts and glomerocrysts up to 3 mm in diameter; 15 percent quartz phenocrysts up to 2.5 mm in diameter, embayed and slightly strained; chlorite (5 percent) as a replacement of the primary mafic mineral (biotite?) and as clumps up to 1.5 mm in diameter. The remainder of the rock is fine quartzofeldspathic groundmass and 5 percent carbonate.

LAWRENCE LAKE BATHOLITH

The Lawrence Lake Batholith is represented in the area by three main phases, an early, marginal, subordinate amphibole diorite to gabbro phase at Sullivan Lake; a northern, intrusive diorite to quartz diorite phase between Bluffpoint and Harris Lakes; and a later granodiorite to trondhjemite phase, south and southwest of Harris Lake. The batholith is skirted for much of its margin by a contact zone consisting of felsite, quartz-rich leucocratic trondhjemite and metasomatized volcanic rocks. Minor aplitic, felsitic, and porphyritic dikes and sparse gabbro and ultramafic rocks of uncertain relationships are also throughout the batholith.

Actinolite Diorite and Gabbro

Medium-grained, green- and grey-weathering amphibole diorite to gabbro forms much of the early marginal subordinate phase of the Lawrence Lake Batholith between Bluffpoint Lake and Sullivan Lake. A complete gradation exists between medium-grained phaneritic texture toward the interior of the batholith and fine-grained, commonly porphyritic (amphibole) texture at the contact with the metavolcanic belt at Sullivan Lake. Contact metamorphic effects within the bordering metavolcanics are not well developed. However, some flows near the contact have a dark grey to black hornfelsic appearance.

The broad chill zone as well as the proximity of this diorite and gabbro intrusion to intermediate metavolcanics at Yoke Lake suggests that in this vicinity, the metavolcanics may be related petrogenetically to the intrusion. Further detailed work is necessary to support this hypothesis.

Mafic to ultramafic phases are elsewhere at the border of the Lawrence Lake and Atikwa Lake Batholiths as can be seen on the Kenora-Fort Frances Sheet (Davies and Pryslak 1967), especially in the Atikwa Lake - Isinglass Lake Area and the Mulcahy Lake Area. These too, could have been feeders for volcanics in the adjacent supracrustal belts.

The two samples of diorite examined in thin section contain the following assemblages. Five percent clinopyroxene, present in one sample, occurs as relict cores in secondary tremolite. In both samples, secondary, pseudomorphic, ragged and fibrous to prismatic tremolite is now the predominant mafic component, comprising 25 to 50 percent of the rock. Saussurite completely replaced plagioclase in both samples, and consists of a mixture of epidote, clinozoisite, chlorite, sericite, and albite and comprises 40 to 50 percent of the rock. In the less mafic sample, 10 percent of the sample is secondary myrmekite of quartz and albite which infringes on the saussurite. Accessory minerals include 2 percent isolated skeletal magnetite grains, and 3 percent skeletal leucoxene.

Diorite and Quartz Diorite

Biotite-hornblende diorite and quartz diorite form the northern intrusive phase of the Lawrence Lake Batholith in the map-area between Bluffpoint Lake and Harris Lake. The western part of the intrusion is diorite which tends to be inhomogeneous, granoblastic, allotriomorphic, and fine to medium grained. Isolated and clotted hornblende prisms and subordinate biotite form from 30 to 40 percent of the rock. Toward the east, the rock generally is coarser grained, more leucocratic with a concomitant increase in quartz content and displays an hypidiomorphic texture. The change in texture and colour index is attributed to contamination of a quartz dioritic magma by the earlier diorite-gabbro discussed previously. Evidence for this is present west of Bluffpoint Lake where numerous, mafic diorite inclusions exhibit partial resorption and agmatic structures.

A sample of the freshest medium-grained quartz diorite was studied in thin section consists of the following assemblage. Green to pale greenish yellow hornblende forms 20 percent of the rock. Rarely relict traces of clinopyroxene are enclosed within the hornblende. The plagioclase (high andesine) is hypidiomorphic, well twinned, and generally exhibits little alteration to epidote. Pale to dark brown biotite forms 6 percent of the rock, occurs interstitially, and rarely shows incipient alteration to chlorite. Quartz is interstitial, exhibits some strain, and forms 10 percent of the rock. Accessory minerals include apatite, minor opaques, and zoned zircon.

Granodiorite to Trondhjemite

The equigranular, leucocratic biotite granodiorite to trondhjemite is the youngest phase in the map-area of the Lawrence Lake Batholith, and is south and southwest of Harris Lake. It exhibits intrusive relations with the other two phases discussed previously. This intrusion is in contact with the supracrustal belt north of Missus Lake but over most of its length it is buffered from the metavolcanic belt by the mixed contact phase discussed later.

Where the granodiorite-trondhjemite is in contact with the supracrustal belt, mafic metavolcanics commonly take on a dark green to black appearance on the fresh surface, with a dark green weathered surface. Sericitic joint-face alteration, chlorite stringers and netted diktyonitic structures are present at various locations in the exocontact zone.

The contact between the granodiorite-trondhjemite and the diorite-quartz diorite is sharp and marked by agmatic breccia in which the latter is included in a matrix of the former. Hornblende xenocrysts are commonly developed in the endocontact of the granodiorite.

A sample of the granodiorite from an island in the west part of Harris Lake in thin section exhibits a "clumpy" allotriomorphic texture in which patches of plagioclase with biotite are separated by patches of quartz and microcline. The following assemblage is present. Zoned and twinned albite plagioclase accounting for 43 percent of the rock exhibits 70 percent sericitic alteration of the more calcic cores. Microcline which forms 10 percent of the sample exhibits rare patchy perthitic and antiperthitic or replacement textures with albite, and rarely rims albite partly or completely. Quartz, exhibiting some strain, forms an interconnecting polycrystalline network accounting for 35 percent of the rock. Yellow to brown to olive green biotite, accounting for 7 percent of the rock, forms isolated, interstitial, polycrystalline clumps. Commonly intimately associated with these clumps are magnetite (3 percent) and epidote (2 percent). Other accessories include trace amounts of zircon, apatite, and tourmaline.

Mixed Contact Zone

A mixed contact zone up to 1000 m thick buffers much of the contact between the granodiorite and trondhjemite phase and the supracrustal belt. The zone varies in composition. There is chloritized or actinolitized diorite and quartz diorite commonly with patchy distribution in felsite and leucocratic trondhjemite containing up to 60 percent quartz. In addition there are metavolcanics with varying degrees of silicic metasomatic alteration.

Two thin sections of metasomatized volcanic rocks were studied; one from the northeast arm of Straw Lake and one from south-central Bluffpoint Lake. Both samples have patchy replacement by metasomatism and are porphyritic. The matrix in both samples is 90 to 95 percent very fine grained anhedral quartz with patches of slightly coarser quartz and 5 to 10 percent muscovite, biotite, and minor epidote. The plagioclase phenocrysts are largely altered to very fine grained sericite and/or clinozoisite and rarely replaced partly by chlorite or epidote. In one sample (Bluffpoint Lake), the patches form almost interconnecting masses 1 to 2 cm across of pale green, magnesium chlorite flakes. Some epidote and magnetite surrounded by intergrown fine-grained biotite and quartz grains form what appears to be a reaction selvage. The fragments also contain relict plagioclase phenocrysts or glomerocrysts which have been largely replaced by chlorite and biotite. The second sample (Straw Lake) exhibits a more vague patchy replacement with the patches consisting of fine-grained quartz and albite (coarser than the matrix) with fine-grained fibrous amphibole, clinozoisite, ferroan carbonate, and sericite.

The source for the felsite, leucocratic trondhjemite, and silica-rich metasomatic aureole of the batholith may be a granophyric phase of the granodiorite-trondhjemite.

JACKFISH LAKE COMPLEX

The Jackfish Lake intrusion (Blackburn 1976a), is part of the Rainy Lake Batholith and consists of relatively uniform, foliated, and lineated medium-grained equigranular rock which is mainly syenodiorite. It varies locally from quartz diorite to syenogabbro. Weathered colour is grey to green but where epidotized it is commonly green to pink.

Other minor subphases of indefinite relationship were identified within the Jackfish Lake Complex. A subhorizontal sheet of porphyritic (K-feldspar) syenodiorite intrudes normal syenodiorite on the eastern island of the group of islands and shoals in Kaiarskons Lake 2300 m southwest of the Loonhaunt River channel. Aplite and pegmatite dikes and patches of varying dimensions are distributed sporadically throughout the complex. Rare, small isolated dikes or inclusions of undetermined dimensions of leucocratic biotite trondhjemite occur within the syenodiorite west of Kaiarskons Lake. These may be related to the leucocratic biotite gneiss which parallels the Jackfish Lake Complex contact, in the exocontact zone west of Cedar Narrows, north and west of Kaiarskons Lake.

A separate pluton of porphyritic (K-feldspar) quartz monzonite was identified in the extreme southeastern part of the map-area. Reconnaissance mapping of this body indicates that it postdates the syenodiorite intrusion and it may represent a major, later subphase of the Jackfish Lake Complex.

Mafic metavolcanics in the exocontact zone of this intrusion have been variably metamorphosed as high as the hornblende amphibolite grade over a zone up to 2 km wide. Rocks in this contact alternate irregularly between greenschist and amphibolite grade and may represent thrust slices. Stromatic and agmatic migmatite are poorly to well developed along the length of the contact, both in the present area and in the Pipestone Lake (South) area (Edwards 1978).

A petrographic description of the main phase is given in Blackburn (1976a) and Edwards (1978) and can be summarized as follows. The minerals are normally present in the ranges indicated:

- Primary minerals
  - plagioclase, 10 percent to 40 percent
  - hornblende, 10 percent to 20 percent
  - clinopyroxene, trace to 30 percent
  - biotite, trace to 30 percent
  - K-feldspar, trace to 30 percent
  - quartz, trace to 15 percent
- Accessory minerals
  - epidote, 0 to 7 percent
  - magnetite, trace to 5 percent
  - sphene, 0 to 2 percent
  - apatite, trace to 2 percent
- Secondary minerals
  - chlorite (after biotite), trace to 5 percent
  - tremolite (after clinopyroxene), 0 to 10 percent

K-feldspar and quartz where present are always anhedral. Pale green to yellow hornblende commonly partly forms late magmatic rims around colourless clinopyroxene, where present. Green to olive biotite rarely forms part of the rim associated with hornblende. Mafic minerals tend to form "clumps" (possible glomeroxenocrysts) in which magnetite forms up to 8 percent of the "clump". The texture of the rock is normally hypidiomorphic and medium to coarse grained.

ESOX LAKE STOCK

A modified circular- to oval-shaped, possibly composite late diapiric stock of fine- to medium-grained, pinkish to orange-weathering (hornblende)-biotite quartz monzonite to granite intrudes the metasediments between Seahorse and Esox Lakes. The stock is wholly contained within the metasediments. A 200 to 300 m wide septum of metasediments occurs between the stock and mafic metavolcanics west of Esox Lake. Agmatite and stromatite and dikes are commonly developed at the contact with the metasediments and some metasomatic activity in the form of partial granitization of metasediments occurs in the contact zone at Seahorse Lake. Vague, grain-boundary foliation within the body is roughly conformable with its shape suggesting that the foliation is a primary one due to laminar flow and that the body may consist of two lobes, one between Seahorse and Esox Lakes and the other at the northwestern part of Esox Lake.

Tight folds present in the metasediments north of the stock may be due to compression during the emplacement of the stock, resulting in considerable modification of an original synclinal structure.

Two samples were studied in thin section; one, a leucocratic biotite granite was taken at the northwest shore of Esox Lake, in the northern lobe; the other, a leucocratic quartz monzonite was taken east of Seahorse Lake, in the southern lobe. The texture in both is allotriomorphic to hypidiomorphic, seriate porphyritic with microcline forming rare poikilitic phenocrysts up to 7 mm in diameter.

In the granite sample, seriate porphyritic microcline forms 55 percent of the rock and commonly exhibits string and patch perthite and replacement (of albite) textures. Fine-grained albite, occurs as distinct, rarely bent, anhedral grains and as exsolution in perthitic grains, forming 15 percent of the rock. Interstitial quartz (20 percent) forms anhedral grains less than 1 mm in diameter and exhibits some strain. Brown to olive green biotite commonly partly altered to chlorite and accounting for 10 percent of the sample occurs as intergranular polyhedral clumps generally less than 1 mm in diameter associated with epidote, magnetite, and rarely hornblende. Accessory minerals include trace amounts of zircon and tourmaline.

The quartz monzonite sample contains the following minerals: quartz, 12 percent; microcline, 45 percent; plagioclase, 33 percent; biotite, 5 percent; epidote, 5 percent; and a trace of hornblende. Microcline has a seriate porphyritic, anhedral nature commonly displaying perthitic and replacement (of albite) textures. Microcline grains up to 4 mm in diameter are present. Plagioclase (albite) occurs as smaller, commonly zoned and twinned anhedra rarely included in the larger microcline grains and as perthitic exsolutions from microcline. Pale brown and greenish brown biotite is commonly associated with clumps or aggregates up to 2 mm in diameter which consist mostly of epidote and rarely hornblende and sphene.

FURLONGE LAKE STOCK

The Furlonge Lake Stock is a roughly lenticular-shaped stock of porphyritic (microcline) biotite-hornblende quartz monzonite located between Bending Lady Lake and Furlonge Lake. The rock is externally similar to the Esox Lake Stock being pale orange to pink but differs in that microcline megacrysts are abundant (20 percent).

There is a contact zone of the intrusion on the island north of the narrows between Furlonge Lake and Bending Lady Lake. Here, contact migmatite with agmatic and raft structures is developed in the partly hornfelsed metavolcanic host. The granitic material at the contact consists of nonporphyritic, fine-grained possibly quartz monzonite and later pegmatite.

The following minerals were observed in thin section: plagioclase (low oligoclase), 40 percent; quartz, 25 percent; microcline 20 percent (interstitial 10 percent, phenocrysts, 10 percent); hornblende, 8 percent; biotite, 5 percent; epidote, 5 percent; sphene, 2 percent. The texture of the sample is allotriomorphic, inequigranular, and medium grained. Quartz forms an interstitial network of mildly strained polyhedra averaging less than 1 mm across. Plagioclase (low oligoclase) occurs as subhedral to anhedral grains, 2 to 3 mm long, commonly twinned, and exhibiting some zoning and sericitic alteration along cleavage planes. The mafic minerals form aggregates up to 3 mm across in which green to brownish green hornblende generally forms the nucleus, surrounded by pale brown to olive brown biotite and epidote with traces of sphene and magnetite.

Late Mafic Intrusive Rocks

Late mafic dikes of variable width and variable but generally gabbroid composition intrude most of the rock-types in the southern half of the map-area. Sparse quartz-amphibole-carbonate gabbroid dikes intrude mafic metavolcanics south of Pipestone Lake. In the Esox Lake area, biotitic amphibole gabbro dikes and other similar mafic rocks including biotite lamprophyre intrude metasediments and quartz-feldspar porphyry. One dike of amphibole (after pyroxene) porphyry about 10 m wide intrudes metasediments semi-concordantly on the west shore of the large island in Sucan Lake. In this sample polyhedral tremolite phenocrysts which may be pseudomorphic after clinopyroxene form 25 percent of the rock. The groundmass is highly altered consisting of ragged to fibrous tremolite (20 percent), carbonate (20 percent), and a finer mesostasis (35 percent) consisting largely of clinozoisite, finer tremolite, magnetite, and quartz.

A sample of amphibole-biotite gabbro taken from the east shore of the island in Esox Lake north of the entrance to Mirror Bay is of 30 percent ragged to pseudomorphic tremolite, after clinopyroxene, occurring as 1 to 2 mm poikilitic grains and as ragged groundmass (less than .25 mm grain size); 20 percent brown biotite commonly intergrown with the finer tremolite; 45 percent partly sericitized, anhedral, plagioclase exhibiting relict diabasic texture with a grain size less than 3 mm.

Phanerozoic

CENOZOIC

Quaternary

PLEISTOCENE

The Wisconsinan stage of glaciation of approximately 12,000 years B.P. (before present) is in part responsible for the shaping of bedrock features, much of the present immature drainage pattern in the area, and for the variable thicknesses of till covering much of the bedrock.

Till

The glacial till is generally silty to sandy and compact, partly filling lower lying areas (sheared and altered zones). Till is particularly thick east of Line Bay and again north of the Manitou Stretch. In both areas it obscures much of the bedrock.

Varved Clay

Varved clay of unknown thickness is present at the bottom of a five foot deep pit dug by the field crew in the western side of the large island in Straw Lake. The clay is overlain by recent beach sand apparently deposited by the present Straw Lake.

Raised Beach Deposits

Raised beach deposits occur 75 to 100 feet above the present lake level east of Seahorse Lake. These are of locally derived boulders forming roughly crescent-shaped, flat-topped ridges, which rim some of the outcrops at a constant elevation. Such deposits can only be attributed to a glacial lake, probably Lake Agassiz.

Sand

Sand rather than till superficially covers much of the bedrock in a zone up to 1000 m wide extending from the western end of Manitou Stretch southwestward to an area east of Lou Lake. The origin of the sand is not known to the author but it may represent a modified glacial feature such as an esker or beach.

RECENT

Lake, stream, and bog deposits of clay, silt, sand, and organic material are presently being formed mainly at the expense of Pleistocene glacial deposits. Organic mud and peat are forming in swamps and muskegs.

STRUCTURAL GEOLOGY

The east-trending, vertically dipping Manitou Stretch-Pipestone Lake Fault divides the area into two distinct structural regimes. The fault is a zone of variable width along which there is intense shearing and carbonatization.

North of the fault, the structural trend is broadly arc-shaped, wrapping around the Lawrence Lake Batholith. Open-fold axes are traceable through Sullivan Lake (anticline) and the north part of Yoke Lake (syncline) but both axial traces merge into a strongly sheared pinch zone at Straw Lake where the belt is narrowest. This zone extends eastward through Mister and Missus Lakes and beyond the map-area. South of Floyd Lake, it merges into the Manitou Stretch-Pipestone Lake Fault.

Rocks south of the fault are more complexly folded. Evidence in the metasediments at Thompson Bay, indicate refolding has taken place. Here, synclinally folded metasediments have been refolded about a northeast-trending, open antiform resulting in a trilobed structure. Three roughly east-trending fold axes have been identified in metasediments north and west of Esox Lake. Structure here has also been modified by the intrusion of a late, granite to quartz monzonite stock between Seahorse and Esox Lake. Tops from pillowed mafic flows between Lou Lake and Line Bay indicate that the mafic flows have been folded or thrust faulted in a complex manner, concurring with evidence found in the metasediments. Pillowed flow units in a zone south of a line drawn between Line Bay and Furlonge Lake have been deformed such that strike direction cannot reliably be determined. Facing-criteria though can be determined in a few outcrops and indicate that fold axes may be extrapolated into the deformed zone with further field work.

Adjacent to the Jackfish Lake Complex, east-west deformation of the supracrustal rock appears to overprint fold structures in a zone 600 m to 1500 m wide. This zone has irregularly regionally metamorphosed mafic (commonly banded) rocks up to amphibolite grade. Northeast-trending structures to the north tend to bend into this zone and become parallel to the contact of the Jackfish Lake Complex.

The subvolcanic quartz-feldspar porphyry located in this zone at the south end of Esox Lake has been cataclastically deformed.

Late, left-lateral faults have offset the contact between the Jackfish Lake Complex and the supracrustal belt.

Folding

Profound deformation, leading to folding has affected all of the supracrustal rocks in the map-area. The east-trending Manitou Stretch-Pipestone Lake Fault divides the area into two parts separating a relatively simply folded northern block from a complexly doubly folded or thrust faulted southern block. No evidence was found in the field to indicate the two subareas might be linked stratigraphically.

Essentially supracrustal rocks in the northern block wrap around the Lawrence Lake Batholith. The general mode of folding is one in which strata are openly folded to the west and northwest and generate into close folds and intensified schistosity in the pinch zone where the supracrustal belt is narrowest (east of Straw Lake) to the east.

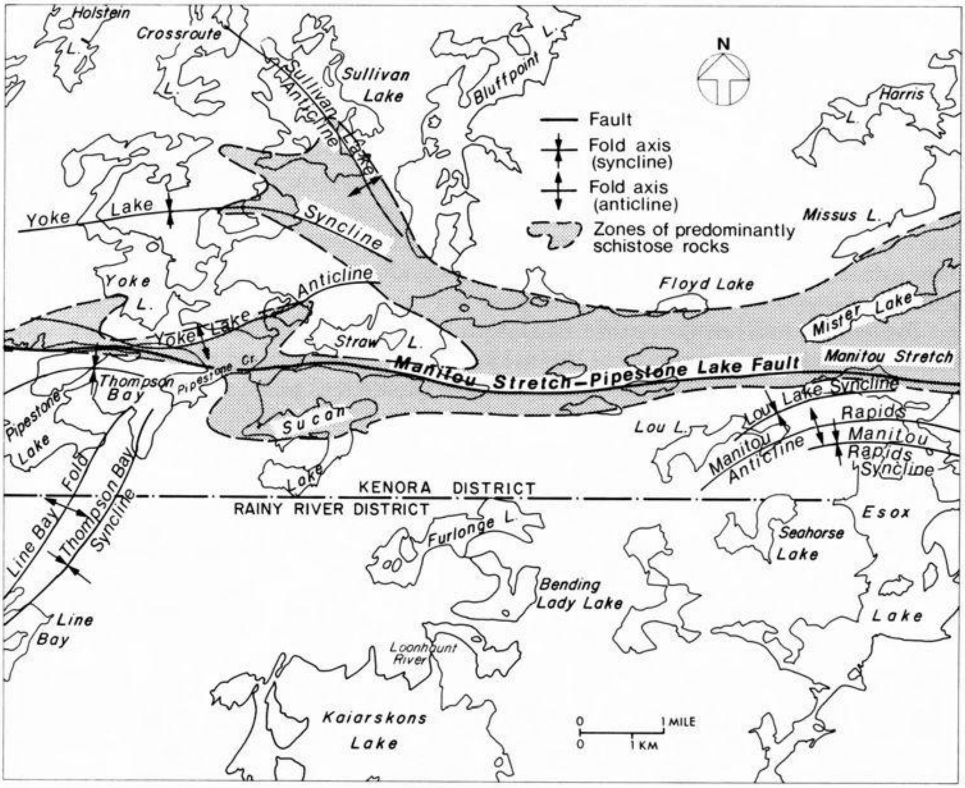


Figure 2–Major structural features in the supracrustal rocks of the Straw Lake area.

NORTHERN DOMAIN

One definite and two probable east-plunging fold axes have been defined in the northwest part of the map-area. These are:

a) a southeast-trending anticline through Sullivan Lake (the Sullivan Lake Anticline). The axis here is defined on the strength of one good top in a pillowed mafic flow in the northern part of Sullivan Lake.

b) an east to east-southeast-trending synclinal axis (the Yoke Lake Syncline) passing through the north-central part of Yoke Lake. This axis was defined by several top-determinations as well as by tracing units around the fold at Yoke Lake.

c) an east to east northeast-trending anticlinal axis (the South Yoke Lake Syncline) in the vicinity of the southern part of Yoke Lake. This axis is tentatively interpreted on the strength of one top-determination in a pillowed mafic to intermediate flow north of the western part of Straw Lake. This axis has been interpreted westward to an area north of Thompson Bay to explain top-data derived from mafic flows. Structural trends here though, may partly be a result of the Manitou Stretch-Pipestone Lake Fault zone.

In the Schistose Lake Area (Edwards 1980) to the west of the present area (south of Bartley Lake), neither the Yoke Lake Syncline nor the South Yoke Lake Syncline can be identified. This is because strata to the west are much more openly folded and become mainly northeast-trending. Facing-criteria just north of Pipestone Lake were not found by the author. In addition deformation and carbonatization related to the Pipestone-Cameron Lake Fault (the western continuation of the Manitou Stretch-Pipestone Lake Fault) have affected much of the rock.

Fold axes are not traceable in the pinch zone east of Straw Lake to as far east as the eastern boundary of the map-area. This is partly due to the deformation imparted on this zone and partly due to the lack of pillowed flows.

SOUTHERN DOMAIN

The overall structural mode in this domain is an eastern continuation of that observed in the eastern part of the Pipestone Lake (South) Area (Edwards 1978). The general configuration is one of accordion-like folding and possible tectonic stacking of strata along northeast-trending axes.

Thompson Bay Fold Structure

That the rocks have been doubly folded has been deduced mainly from the structure as was observed originally described by Thomson (1936) in the metasediments of the Thompson Bay area where facing-criteria (flows, load casts, flame structures, and graded bedding) are abundant enough to delineate a trilobed syncline the west and southwest arms of which are folded about a northeast-trending antiform (Thompson Bay antiform). The antiformal axis merges with the third arm of the syncline east of Thompson Bay. Exposure is poor in this area but outcrops west of Sucan Creek exhibit strong deformation including small-scale chevron folding.

Parasitic folds of short wave length are developed in metasediments southeast of Thompson Bay south of Pipestone Creek. The amplitude of these folds appears to be at least 1000 m. This style of folding seems to have been developed on the south shore of the large island which separates Thompson Bay from the rest of Pipestone Lake but small-scale reversal of tops here may be related to the Manitou Stretch-Pipestone Lake Fault.

Strongly contorted metasediments at the east tip of that island and small-scale "W." drag folds in bedding in metasediments at the western shoreline of the same island are coincident with the western synclinal axis of the Thompson Bay metasediments. Likewise, strongly contorted bedding is present in exposures in the southern part of the south limb of the synclinal structure.

Esox Lake Fold Structure

Metasediments, similar in nature to those at Thompson Bay, occur in the vicinity of the northern part of Esox Lake. Evidence from the facing-criteria in these rocks indicate three fold axes of short wave length are present between the Esox Lake Stock and the Manitou Stretch. It is very likely that some of the folding in the metasediments here may be a result of the emplacement of the late Esox Lake Stock.

Tops in pillowed flows north and northeast of Lou Lake indicate the metasediments overlie these flows. The general shape of the metasedimentary structure between Lou Lake and Seahorse Lake suggests to the author that the overall structure is synformal, modified by the emplacement of the Esox Lake Stock. The syncline was not traced into the metavolcanics to the south because of the lack of top-data present in the rocks in this vicinity.

At the eastern edge of the map-area in a peninsula between the Manitou Stretch and the entrance to Canoe Bay (Esox Lake), mafic flows are bounded to the north and south by metasediments. South-tops occur in pillowed flows in one outcrop on the south shore of the peninsula. The mafic flows, here, are interpreted to lie below all of the metasediments and thus form the core of a west-plunging anticline, although, it may be that the flows are interbedded with the metasediments, a phenomenon which has not been seen elsewhere in the map-area or in the metasediments in the Schistose Lake Area (Edwards 1980).

S dragfolds in the metasedimentary schist along the south shore and schistose mafic flows along the north shore of the west end of the Manitou Stretch plunge between 25 and 35 degrees to the west. In this location, such dragfolds could be attributed to the Manitou Stretch-Pipestone Lake Fault rather than to folding.

Folding in the Metavolcanics

Folding in the metavolcanics is less obvious than in the metasediments. This results from the paucity of key beds to facing-criteria in some areas. Fold axes may be extrapolated from the general outline of the metasedimentary structures but it is thought by the author that the metasediments have generally behaved less competently than the metavolcanics during deformation resulting in discordance in structures between the sediments and the volcanics. Such a problem arises in defining the Thompson Bay anticline in the metavolcanics. Southwest of Thompson Bay a thick sequence of pillowed mafic flows faces northwest on the northwest side of the anticline. Southeast of the axis though, there are no correlatable pillowed flows; in fact pillowed flows are almost entirely absent. Instead, only fragmental mafic metavolcanics are exposed. One possibility is that the mafic flows were thrust faulted before the deposition of the sediments and folding.

East of Sucan Lake a narrow band of mafic fragmental rocks similar to those underlying the metasediments strikes roughly north, oblique to the regional foliation. Small, highly contorted disjointed remnants of metasediments are also found associated with the fragmental unit. These are interpreted as infolded equivalents of the Thompson Bay metasediments and mafic volcanic fragmental rocks.

North of Lou Lake mafic flows are south-facing whereas north and northeast of Furlonge Lake the mafic flows are north-facing (from pillows). A syncline is tentatively interpreted between these two areas. Alternatively, occult thrust or gravity slide faulting may be responsible for the facing reversal.

The driving mechanism for gravity sliding in this part of the Wabigoon Subprovince is the emplacement of the Ash Bay gneissic diapir in the Rainy Lake Batholith. The alternating strongly- and weakly-deformed and metamorphosed rocks in the exocontact of the Jackfish Lake Complex almost certainly resulted from tectonic stacking.

Other indicators of thrust or gravity slide faulting in the map-area are: *1)* Between Lou and Furlonge Lakes a reversal of facing in mafic flows has no obvious fold axis. *2)* Southwest of Thompson Bay a thick sequence of pillowed mafic flows faces northwest on the northwest side of the Thompson Bay antiform. However, there are no correlatable opposite facing pillowed flows on the other limb of the anticline.

The thrust plane may lie along the northwest edge of the intermediate and felsic metavolcanics southwest of Thompson Bay and with further detailed field work may be extrapolated to Esox Lake.

However, as fold axes and strata approach the contact with the Jackfish Lake Complex, they tend to parallel the contact. This has been observed in the Pipestone Lake (South) Area (Edwards 1978). In the present area, this change in direction is manifested by the string of mafic and ultramafic intrusions which extend from Sucan Lake to Line Bay and south of the southwest arm of Pipestone Lake (Edwards 1978).

Faults

THE MANITOU STRETCH-PIPESTONE LAKE FAULT

The east-trending Manitou Stretch-Pipestone Lake Fault is the only fault of major proportions in the map-area. It is part of a regional fault which extends southeastward from the Lake of the Woods area to the present area, and then northeastward into the Manitou Lakes area. The fault has been named differently in other areas. In the Schistose Lake Area (Edwards 1980), it is called the Pipestone-Cameron Lake Fault whereas in the Lower Manitou-Uphill Lakes Area, it has been named the Manitou Straits Fault by Blackburn (1976b). The fault is confined to the supracrustal belt along its entire length and to the author's knowledge no worker has yet been able to definitely match volcanic or sedimentary strata on either side of the fault.

In the present area, no structural or stratigraphic features present on one side of the fault can be identified with similar features on the other side. The fault zone consists of a 70 to 300 m wide zone of carbonatization, shearing, or both. Carbonatization is more common in the west and central part and some outcrops along the south shore of Straw Lake are almost completely carbonate.

Rocks along the north shore of the Manitou Stretch on the other hand are both sheared and carbonatized.

Crenulated schist along the north shore of the Manitou Stretch indicates that at least the latest movement along the fault caused the north block to move up relative to the south block. Like evidence for a relatively similar movement is present in a schist zone in deformed mafic flows at the northeast edge of the large peninsula in the centre of Sucan Lake. This latter zone is not part of the Manitou Stretch-Pipestone Lake Fault.

OTHER FAULTS

Small-scale subvertical faulting appears to be associated with folding in the Yoke Lake area. These faults are evident by offset strata in the nose of the Yoke Lake Syncline.

A possible fault lies along the south shore of the northern part of Sucan Lake and is marked by subvertical schistosity on the northern tip of the peninsula in Sucan Lake.

Late Faults

Several right-lateral faults offset the contact between the Jackfish Lake Complex and the supracrustal rocks. One such fault passes through Cedar Narrows. On the tip of the small peninsula just north of Cedar Narrows, east-southeast-trending schistosity in quartz-feldspar porphyry is dragged northward indicating that the fault postdates deformation of the supracrustal rocks.

Foliation and Schistosity

Foliation is present in most of the rocks in the map-area. In the supracrustal rocks it is mainly due to regional stresses during tectonism but in the Lawrence Lake Batholith, the Esox Lake Stock, the Furlonge Lake Stock, and the Jackfish Lake Complex, foliation is a primary igneous feature.

SUPRACRUSTAL ROCKS

North of the Manitou Stretch-Pipestone Lake Fault east- to southeast-trending, subvertical foliation, grading into schistosity, converge into the pinch zone east of Straw Lake. This is concurrent with the trend of fold axial traces in this zone. The axial traces tend to be more strongly deformed than adjacent rocks. Several other zones of schistosity which were not axial planar are present between Sullivan Lake and Thompson Bay.

Some relatively fresh metavolcanics in the central Yoke Lake area are little deformed probably as a result of stress being taken up in shear zones on either side of the Yoke Lake synclinal structure.

East of Straw Lake to the eastern boundary of the map-area most rocks have a strong east- to east-northeast-trending schistosity. This deformation is most evident in the felsic metavolcanics and subvolcanic rocks which extend from Straw Lake to an area between Mister and Missus Lakes and beyond the map-area. Between Mister Lake and the Manitou Stretch schistosity is not as pronounced except adjacent to the Manitou Stretch-Pipestone Lake Fault.

In the block south of the fault, foliation is poorly developed and throughout this belt tends to be subparallel to the contact with the Jackfish Lake Complex.

Strongly developed schistosity is present in metavolcanics north of, and the metasediments northwest of Sucan Lake. The former is attributed by the author to deformation in the Manitou Stretch-Pipestone Lake Fault zone and the latter to interference deformation resulting from two folding episodes in the Thompson Bay metasediments and/or deformation along the Manitou Stretch-Pipestone Lake Fault.

In general, foliation is not present in the metasediments and deformation was probably taken up along bedding planes.

Subvertical northeast-trending axial planar cleavage in some metasediments is in the outcrops on the southwest shore of Thompson Bay (Photo 12). A foliation in mafic flows southwest of this location parallels the axial planar cleavage which indicates that at least some of the foliation in the south block is related to the second folding event.

In general, the degree of schistosity increases southward toward the contact with the Jackfish Lake Complex. Plagioclase phenocrysts in mafic flows 500 m north of the west end of Furlonge Lake are stretched to a length of 3 to 5 cm and resemble stretched lapilli fragments. Deformation and metamorphic grade do not uniformly increase toward the contact but strongly deformed and metamorphosed zones alternating with less deformed and metamorphosed zones, may be evidence for tectonic stacking.

PLUTONIC ROCKS

Rocks of the Lawrence Lake Batholith are foliated roughly parallel to the contact with the supracrustal belt. Contacts within the batholith are also subparallel to its margin. Foliation is defined in these rocks by the alignment of biotite and /or hornblende. The late quartz-rich leucocratic trondhjemite border phase which contains very little mafic content does not exhibit foliation. The mixed contact phase also is devoid of foliation.

The Esox Lake Stock exhibits very vague foliation along quartz and feldspar boundaries. Although most of the foliations are roughly east-trending, foliations in the intrusion east of Seahorse Lake diverge eastward and converge again toward the shore of Esox Lake in an elliptical shape probably outlining vertical lamellar flow roughly parallel to the shape of the intrusion. This indicates that the Esox Lake intrusion could be two closely related subphases. This is supported by the variable microcline content observed in thin section in the

OGS 10 437

Photo 12–Axial planar cleavage perpendicular to bedding, in interbedded mudstone and graded wacke. Southwest shore of the large island between Thompson Bay and Pipestone Lake.

northern and southern parts of the pluton (see section "Esox Lake Stock").

The Jackfish Lake Complex is a foliated and lineated, mainly syenodioritic, intrusion. The foliation is exhibited by the planar alignment of mafic clots commonly consisting of biotite, hornblende and pyroxene and of individual mafic minerals. Further descriptions of petrography and field relations are given by Edwards (1978).

A semi-detailed study of the structure of the Jackfish Lake Complex was conducted during the field season by R. Sutcliffe in pursuit of a Bachelor's Thesis at the University of Toronto. His study of foliation and lineation including the application of macrofabric and microfabric analyses to calculate "K" values which estimate the degree of finite strain present in the rock (Flinn 1965) have led him to conclude that the body is a modified, crescent-shaped pluton, as described by W.M. Schwerdtner (1976). Some general considerations of the data were published as part of the University of Toronto, Geotraverse Studies (Schwerdtner *et al.* 1978).

GNEISSOSITY

Amphibolitized mafic metavolcanics in a 700 to 2000 m wide zone adjacent to the Jackfish Lake Complex commonly exhibit varying degrees of gneissosity and features similar to those described in the same contact zone in the Pipestone Lake (South) area (Edwards 1978).

LINEATION

Lineation measurements were taken at numerous locations on such features as kinks, crenulations, and elongated fragments in some volcanic rocks in the supracrustal rocks north of the Manitou Stretch-Pipestone Lake Fault. No structural pattern attributable to either folding or faulting is discernible.

Lineation of shallow west-plunging "S" drag folds in schistosity in rocks along the shore of the Manitou Stretch may be related to displacement in the Manitou Stretch-Pipestone Lake Fault zone.

Subhorizontal asymmetrical microcrenulations in the plane of schistosity in schists especially in shoreline exposures along the Manitou Stretch yielded a vertical sense of movement with the north block moving up relative to the south block (at least for the last movement) along this part of the Manitou Stretch-Pipestone Lake Fault. Slickensides in slate near the east end of a small lake 2300 m west of Manitou Stretch plunge steeply to the west (75 degrees).

In the deformed zone adjacent to the Jackfish Lake Complex, plagioclase phenocrysts in mafic flows are stretched to varying degrees. In the western part of the zone, stretched phenocrysts plunge from 60 to 80 degrees south-southeast to east. Southeast of Furlonge Lake however, most of the plunges near the contact are steeply south. West of Cedar Narrows plunges are more to the west and northwest at much shallower angles (45 to 50 degrees).

DRAG FOLDS

Several small-scale "S" and "Z" drag folds in metasediments are in shoreline exposures at Esox Lake. The plunge of most were not obtainable due to the nature of the exposure. These drag folds can be attributed to folding associated with the plastic deformation of the Esox Lake sediments upon intrusion of the Esox Lake Stock.

"W" drag folds in bedding are present at the apparent nose of the west limb

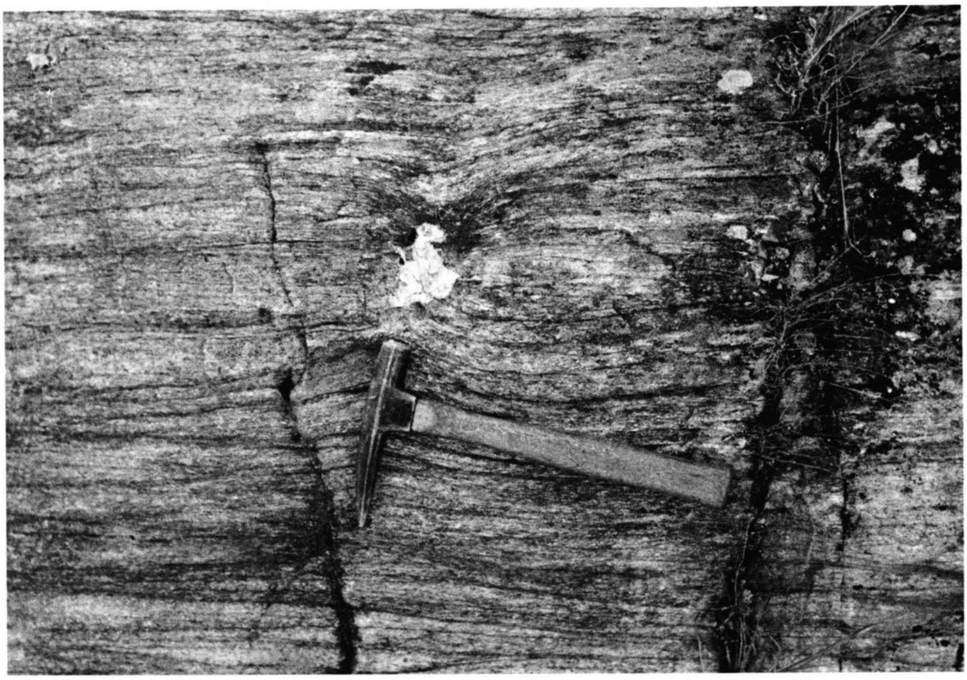


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Photo 13–Cataclastic (phyllonitic) deformation of quartz-feldspar porphyry. The rock commonly exhibits flaser structure. Here, quartz has migrated into the neck of a pinch-and-swell structure. North shore of the peninsula in Esox Lake, 1200 m north-northwest of Cedar Narrows.

of the Thompson Bay synclinal structure. In addition, "Z" drags in bedding occur in the metasediments on the west shore of Thompson Bay and comply with the structure since they are on the northwest side of the Thompson Bay antiform.

CATACLASTIC DEFORMATION

The quartz-feldspar porphyry stock at the extreme south end of Esox Lake lies in the deformation zone associated with the Jackfish Lake Complex and has been cataclastically deformed. It is more common for felsic rocks (porphyries) to exhibit this kind of deformation in zones of great strain (Spry 1969). The rock is homogeneous quartz-feldspar porphyry in which ribbony mylonitized (phyllonite) zones and broad-scale flaser textures are developed.

Boudinage or pinch-and-swell structures in the competent zones are common and the long axis of the boudins appears to be subhorizontal. In some, quartz has filled the low pressure "necks" of the boudins (Photo 13). Similar features occur in some quartz-feldspar porphyry exposures farther north of Esox Lake but these are not as well developed. In some outcrops the cataclastically fragmented rock resembles a pyroclastic rock but the boundaries of most fragments grade into the finer matrix surrounding them rather than having precise boundaries.

ECONOMIC GEOLOGY

The presence of gold in the area has been known since the early 1930s when gold was identified at four locations on or near Straw Lake (Thomson 1935). Present mapping has revealed new exploration possibilities in an area that has not previously been considered a prime target. These are discussed under the heading "Suggestions for Exploration" later in this section.

Exploration for base metals has been sporadic in the last 25 years. Airborne and/or ground geophysical surveys have covered much of the area.

Suggestions for Exploration

GOLD

It is recommended by the author that the area between Straw Lake and Manitou Stretch-Mister and Missus Lakes be examined for gold mineralization similar to that of the Straw Lake Beach Mine. Emphasis should be put on structural control of mineralization and hydrothermal activity related to emplacement of the Lawrence Lake Batholith. The fact that four main gold occurrences in the vicinity of Straw Lake occur in different rock types supports a hydrothermal origin for gold in this vicinity. Also it was found by the author that some outcrops along the south shore of Straw Lake near the Straw Lake Occurrence contain a fracture cleavage trending in a north-northeast to northeast direction, almost perpendicular to the normal east-striking schistosity of adjacent outcrops. A similar cross cleavage was observed by the author in felsic pyroclastic rocks south and east of the Straw Lake Beach Mine. Two northeast-trending photo lineaments located in the pyrite-rich trondhjemitic border subphase of the Lawrence Lake Batholith between Straw Lake and Floyd Lake strike toward the mine area and may be related to the cross cleavage which subsequently could have been avenues for mineralization.

Assay of a grab sample of brown-weathering, altered trondhjemite containing no visible sulphide mineralization taken from a small outcrop located 900 m north of the eastern end of Floyd Lake in the Lawrence Lake Batholith yielded 0.54 oz. per ton gold. Assay was performed by the Geoscience Laboratories, Ontario Geological Survey. The occurrence of gold within the batholith at this location suggests that the mechanism for the deposition of gold may be related to the hydrothermal system which deposited gold at Straw Lake as postulated above. Exploration for gold in both the endocontact and exocontact zones of this part of the Lawrence Lake Batholith is warranted especially in areas of intersecting cleavage between the Lawrence Lake Batholith and the Manitou Stretch-Pipestone Lake Fault.

A grab sample was taken from a 2.5 cm wide quartz vein, trending N35W and dipping 60 degrees to the northeast, in a quartz-feldspar porphyry dike located 100 m north of Yoke Lake and 1575 m west of the creek into Crossroute Lake. This sample assayed 0.32 oz. of gold per ton. Assay was performed by the Geoscience Laboratories, Ontario Geological Survey.

Arsenopyrite and pyrite occur in a carbonatized and chloritized felsite dike on the shore of Yoke Lake, 600 m west of the creek into Crossroute Lake. The mineralization which occupies two shallow-dipping, ill-defined zones 1 cm to 5 cm thick consists of disseminated cubes and pyritohedra of pyrite and disseminated blades of arsenopyrite in amounts up to 10 percent. No gold or silver was present in a grab sample taken by the author and analyzed by the Geoscience Laboratories, Ontario Geological Survey.

The author recommends that the vicinity of the two occurrences just described be further examined for gold mineralization.

BASE METALS

General

Massive pyrite and pyrrhotite is in shoreline exposure at the west end of Furlonge Lake. Massive pyrite-pyrrhotite and/or magnetite-bearing chert are known to occur southwest from Furlonge Lake at a) the entrance to Stonedam Lake (Edwards 1978), b) southeast of the entrance to Stonedam Lake (from diamond drilling performed by the Canadian Nickel Company Limited, Edwards 1978), and c) south of the south arm of Pipestone Lake (Thomson 1936). This zone which semi-continuously exhibits magnetic contrast with the surrounding rocks extends parallel to and occurs in the exocontact of the Jackfish Lake Complex. The lateral extent of these occurrences indicates that the zone may represent a semi-continuous stratiform horizon in which copper or zinc deposits could occur.

Copper

A north-trending zone of malachite- and azurite-stained massive to disseminated pyrite, chalcopyrite, and gossan is exposed over 2 m in a blasted pit on the north shore of a small bay almost due north of the extreme southeastern part of Sullivan Lake. A chalcopyrite malachite- and azurite-stained selected grab sample taken from the pit by the field party and quantitatively analyzed by the Geoscience Laboratories, Ontario Geological Survey contained 7.40 percent copper and 0.18 oz. per ton gold. Mineralization here appears to be associated with subhorizontal fractures filled with carbonate and quartz but pyrite also fills some amygdules in the black mafic flow host.

The copper and gold occurrence at Sullivan Lake may be of similar genesis as the copper and gold at Maybrun Mine located on the west shore of Head Bay, Atikwa Lake, (Davies 1973) where chalcopyrite, at least in part, occupies pillow interstices in mafic flow. Both of these occurrences could be similar to the cupreous pyrite-type deposit as at Cyprus (Hutchinson 1965) related to successive phases of early mafic volcanism.

Another interesting copper occurrence is located on the north shore of the northeast arm of Straw Lake on the property of A.J. Eustace (the Konigson Occurrence), claim K2550. The property was originally explored for gold in the 1930s and 1940s but apparently has never been investigated with base metals in mind. A grab sample taken by the author at the opening of the shaft consisted of 75 percent pyrite and chalcopyrite in a quartz-sericite gangue. The sample analyzed 39.18 g/tonne gold and 8.81 percent copper (Geoscience Laboratories, Ontario Geological Survey, Toronto).

Property Description

CANADIAN NICKEL COMPANY LIMITED (1)[1]

In 1969, diamond drilling was performed at eleven locations across the map-area (Figure 3) in areas of magnetic and/or electromagnetic anomalies. The nature of the conductor and the depth of each drill hole are recorded in Table 2. No further work was submitted for assessment and all but two claims were allowed to lapse. These claims, K44051 and K44052 are located 900 m north of Lou Lake at Location 15, Figure 3.

CONWEST EXPLORATION COMPANY LIMITED [1952] (2)

In 1952 Conwest Exploration Company Limited investigated a property at the west end of Furlonge Lake (Corrigan option) using ground magnetometer and subsequent diamond drilling. The property was staked over an area containing several exposures of massive pyrite and pyrrhotite. The magnetic survey indicated vertically dipping, lenticular mineralized zones striking westward under the western part of the lake. Diamond drill logs were not submitted for assessment. Diamond drill locations are shown on Figure 3 and claim numbers are recorded in Table 2.

[1]Number in parentheses refers to the property number on Map 2463 (back pocket).

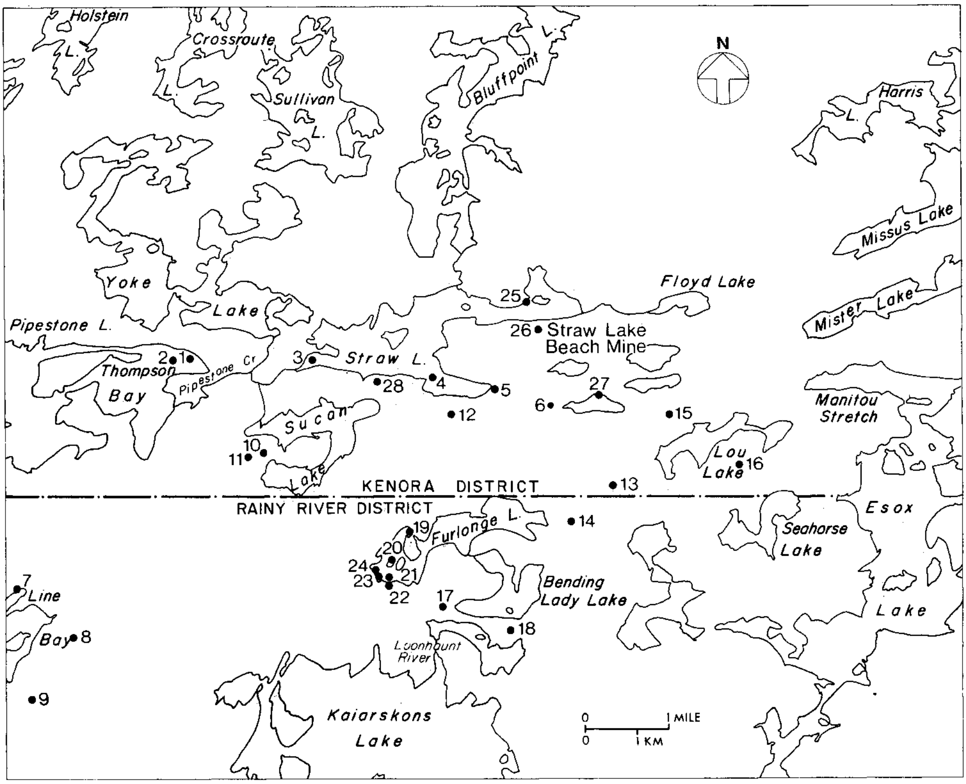

Figure 3–Location of properties and diamond drill sites, Straw Lake area.

A.J. EUSTACE (3)

The Konigson Occurrence (currently owned by A.J. Eustace) was discovered by E. Konigson in pyritized, schistose intermediate metavolcanics on the north shore of the northeast arm of Straw Lake (Figure 3). As reported in Thomson (1935, p.21), the mineralization is in a roughly vertically dipping zone up to 3 m wide, striking approximately N80W consisting of "quartz, carbonate, and schist, all rather heavily impregnated with pyrite and a trace of chalcopyrite, and carries commercial values in gold".

Work on patented claims K2549 and K2550 consisted of thorough stripping, mapping and trenching and a shaft was sunk 40 feet at the discovery site on claim K2550.

One thousand feet of diamond drilling on the main Konigson shear (in the vicinity of the shaft on claim K2550) was recommended in a report by G. Holbrooke (1944) for Sylvanite Gold Mines Limited. Six diamond drill holes were drilled in 1945, in the area recommended. The maximum assay value recorded

TABLE 2 DIAMOND DRILLING AND SURFACE TRENCHING DATA

Location Number in Figure 3	Claim Numbers	Company or Property	Date of Exploratory Work	Reported Conductor or Geology	Feet Drilled or Trenching	Maximum Reported Assay results in ppm
1	K268562	Freeport Canadian Exploration Co.	1971	graphite	300 ft. (d)	38 Cu, 36 Zn, 0.8 Ag
2	K268561	" " "	1971	"	300 ft. (d)	72 Cu, 38 Zn, 1.2 Ag
3	K269344	" " "	1971	"	350 ft. (d)	150 Cu, 130 Zn, 0.5 Ag
4	K269338	" " "	1971	"	301 ft. (d)	180 Cu
5	K269330	" " "	1971	graphitic fault zone	350 ft. (d)	195 Cu, 1500 4.0 Ag
6	K269322	" " "	1971	graphite	303 ft. (d)	1100 Cu, 1000 Z 2.5 Ag
7	K268845	" " "	1971	pyrrhotite, pyrite	420 ft. (d)	380 Cu, 2200 Z 3.0 Ag
8	FF19147	Canadian Nickel Company Ltd.	1969	" "	322 ft. (d)	
9	FF19127	" " "	1969	" "	325 ft. (d)	
10	K44056	" " "	1969	peridotite	612 ft. (d)	
11	K44174	" " "	1969	pyrite, pyrrhotite	272 ft. (d)	
12	K202655	" " "	1969	graphite, pyrite	141 ft. (d)	
13	K45097	" " "	1969	graphite, pyrrhotite, pyrite	514 ft. (d)	
14	FF19134	" " "	1969	graphite, pyrrhotite, pyrite	672 ft. (d)	
15	J44053	" " "	1969	no conductor recorded	131 ft. (d)	
16	K44164	" " "	1969	graphite	150 ft. (d)	
17	FF19156	" " "	1969	pyrrhotite, pyrite	449 ft. (d)	
18	K202401	" " "	1969	pyrrhotite, peridotite	679 ft. (d)	
19	FF5513, FF5510	Conwest Exploration Company Ltd.	1952	pyrite, pyrrhotite ?	unknown (d)	
20	FF5515	" " "	1952	" " ?	" (d)	
21	FF5519	" " "	1952	" " ?	" " (d)	
22	FF5519	" " "	1952	" " ?	" (d)	
23	FF5514, FF5518	" " "	1952	" " ?	" (d)	
24	FF5514, FF5518	" " "	1952	" " ?	" (d)	
25	K2550	A.J. Eustace Property (Konigson Occurrence)	1944	schist with quartz veins	6 holes, 1,119 ft. (d) (t)	39.8 g/t Au[1], 8.81% Cu

26	K3943, K3944	Minedel Mines Ltd. (Straw Lake Beach Mine)	1935	sericite schist with quartz veins	unknown	(d) (t)	.64 oz /t Au[2] (max. average)
27	K4290, K4291, K4292	S.J. Viger Property	1934	intermediate lapilli- tuff and sericite schist	unknown	(t) (d?)	.07 oz/+ Au[3] $2.45 @$35.00 Au oz.
28	K4016, K4017	Straw Lake Occurrence (Straw Lake Mining Syndicate)	1934	feldspar porphyry and quartz veins	unknown	(t) (d?)	$14. Au/ton @ $35 oz.[3]
29	K4021-22, K4035-40, K9037-38	J.A. Mathieu Estate Property	1934?	feldspar porphyry and quartz veins	unknown		unknown

1 This report

2 Maximum value as reported in Thomson, (1936).

3 Maximum value as reported in Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora.

from this drilling was $27.60/ton at a gold value of $35.00/oz although most values reported were trace amounts. Assay values of samples taken from surface trenches in the mineralized zone yielded generally higher results between trace amounts and $32.80/ton at a gold value of $35.00/oz (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

A grab sample taken by the author from a 5 to 10 cm wide zone consisting of 75 percent pyrite and chalcopyrite in quartz and sericite gangue located at the opening of the shaft on the north shore of the northeast arm of Straw Lake in claim K2550, analyzed 39.18 g/tonne gold and 8.81 percent copper. Patented claims K4390, K4355, and K8233 are held by Eustace.

A.J. Eustace also owns a group of eight patented claims; K4099, K4100, K4102, K4103 and K5142 to 45, located north and west of Mister Lake. The rocks here are mainly sheared, interlayered intermediate, felsic, and mafic metavolcanics similar to those in the vicinity of Straw Lake. The reason for the original staking and retention of these claims is not known to the author.

FREEPORT CANADIAN EXPLORATION COMPANY [1971] (4)

In 1971, Freeport Canadian Exploration Company diamond drilled at seven locations in the map-area, mainly in the Manitou Stretch-Pipestone Lake Fault zone (Figure 3). A summary of drilled depths and reported intersected conductor and assay values is recorded in Table 2. Diamond drill logs are on file at the Assessment Files Research Office, Ontario Geological Survey, Toronto.

The diamond drilling followed a large-scale airborne electromagnetic and magnetic survey by Questor Surveys Limited using a Mark V Input System and a Barringer AM 101A Proton Precession Magnetometer. The survey spanned an area, mainly over the Wabigoon supracrustal belt from the southwestern part of Pipestone Lake to an area east of Esox Lake (Assessment Files Research Office, Ontario Geological Survey, Toronto).

J.A. MATHIEU ESTATE (5)

The Mathieu "claim" is located just west of the Straw Lake Occurrence [1934?] (9) on the western extension of the same gold-bearing feldspar porphyry dike (see Map 2463, back pocket and Straw Lake Occurrence). The dike on this property is exposed on claim K4022 which is still in good standing. Other adjacent claims, currently the property of the estate of J.A. Mathieu are K4021, K4035-40, K9037, and K9038.

G.H. MCKAY (6)

In 1976 four patented claims K3999-4002 were held by G.H. McKay just west of the Straw Lake mine. No records of exploration are on file.

MINEDEL MINES LIMITED (7)

(Straw Lake Beach Mine)

Mineral production in the area has been limited to one past gold producer, the Straw Lake Beach Mine (patented claims K3944, K3943, K3945, and K3946) which produced 11,568 oz. of gold and 1,049 oz. of silver from 33,662 tons of ore (Ferguson *et al.* 1971). This mine was located in schistose sericitic and silicified intermediate to felsic metavolcanic rocks. Rocks in the vicinity of the mine exhibit varying degrees of brown staining and alteration as well as a pervasive schistosity. In some zones it is difficult to estimate the composition of the rock due to the alteration which appears to be in part chloritic and sericitic. The large body of felsic flow south of the mine is cleaved along closely spaced fractures in a direction concordant with the schistosity in adjacent rocks.

The mineralized zone (Mosher vein) which was traced for about 1,000 feet along strike is described by Thomson (1936, p.26) as follows:

> The Mosher vein is located along a sheared zone in acid lava. Its general strike is N.80°E, although in the central section it swings to about N.60°E. The dip is about vertical. The vein material consists of quartz and schist containing varying amounts of pyrite, chalcopyrite, tetradymite (bismuth telluride), and native gold. Gold, magnetite and sphalerite have been found by microscopic examination of the ore. Visible gold occurs frequently and is always closely associated with the tetradymite.
>
> The vein quartz is from 2 to 25 inches. At some places, and especially near the shaft, it branches into small, closely spaced, parallel veins and has the form of a lode. In some of the pits east of the shaft only small irregular veinlets of quartz are found in the sheared zone, but sulphide mineralization occurs. Vein quartz is again found in the pits near No. 4 pit.
>
> Two types of schist are associated with the vein quartz: a light-coloured silicified schist with sulphides, and a dark-coloured chloritic schist. It has been found that the light-coloured silicified schist carried gold values, whereas the dark-coloured variety generally contains only traces of gold. In some places in the drift on the 100-foot level the silicified schist along the sheared zone carries sufficient gold values to make ore, even when the quartz vein pinches out..."

Assay data were reported by Thomson (1936, p.27) as follows:

> Surface sampling of the Mosher vein during the summer of 1934 indicated that a section of it, 600 feet in length (from pit No. 28 to pit No. 4), averaged 0.80 ounces of gold across an average width of 13.4 inches.

According to Thomson (1936) a 125-foot mineralized zone known as the Sulphide vein was uncovered west of the mine, slightly north of the projected strike of the Mosher vein. Gold values were reported from a few grab samples but there is no evidence of further work.

The Straw Lake Beach Mine property (K3943-46) is presently owned by Minedel Mines Limited (Northern Miner Press 1975, p.186). Diamond drilling and mapping by Projex Limited was in progress during the author's visits in the summer of 1976.

PROJEX LIMITED (8)

During the summer of 1976 Projex Limited staked a group of 12 claims, K477989-478000 in the vicinity of the Straw Lake Beach Mine (Minedel Mines Limited property). At the time of writing no information was available concerning exploration.

STRAW LAKE OCCURRENCE [1934?] (9)

The original gold occurrence as discovered by W. Lucy in 1933 and explored by the Straw Lake Mining Syndicate in 1934 was located on now cancelled, patented claims K4016 and K4017. The occurrence consists of gold-bearing quartz veins in a vertically dipping feldspar porphyry dike trending west to northwest. The dike which was originally traced for 1,950 feet through carbonatized and mainly schistose mafic, intermediate, and felsic metavolcanics varies in width from 1 m to 5 m and where observed by the author in the field, has a sharp intrusive contact.

The gold-bearing quartz veins were reported by Thomson (1936, p.28) to be "...almost always less than 6 inches in width and in places form a pattern that suggest they occupy tension cracks developed in the dike on cooling". Thomson (1936, p.28) also reported "A little native gold has been found in the quartz".

S.J. VIGER PROPERTY (10)

The Viger property consists of three patented claims K4290, K4291, and K4292, located about 2 km east of the southeast arm of Straw Lake. The claims are underlain by schistose to massive intermediate, mafic, and felsic metavolcanics in the vicinity of the Manitou Stretch-Pipestone Lake Fault zone.

Records of assayed channel and other samples dated 1934 and 1935 are in the Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora indicating that at least surface work was performed (Table 2). None of the workings were located in the field by the author.

REFERENCES

Blackburn, C.E.

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INDEX

PAGE

Agassiz, glacial Lake 43
Agmatite dikes 40
Amphibole diorite 36
Amphibolite 11,39
Analyses 55,56,60
  Chemical 22
See also: Assays.
Andesite flows:
  Photos 16,17
Anomalies 56
Anorthosite 32
Anticlines:
  Sullivan Lake 44,45
  Thompson Bay 10,20,47,48
Antiform, Thompson Bay 23,46,53
Aplite dikes 39
Arsenopyrite 33,55
Assays 55,57,60,61
See also: Analyses.
Axial planar cleavage 50
  Photo 51

Bartley Lake 8
Bending Lady Lake 5,11,41
Biotite granite; thin section 40
Bluffpoint Lake 36,37,39
Bouma sequences 25,28,30
Breccia 35
  Mafic flow 31
    Photo 13
  Mafic hyaloclastic:
    Photo 14

Canoe Bay 25,47
Carbonatization 8,43,46,48
Cedar Narrows 39,49,52
Chalcopyrite 55,56,60
Chemical analysis 22
See also: Analyses; Assays.
Chert, magnetite-bearing 55
Claims:
  K2547 57
  K2550 56,57,60
  K3943-46 61
  K3999-4002 60
  K4016-17 62
  K4021-22 60
  K4035-40 60
  K4099-4100 60
  K4102-03 60
  K4290-91 62
  K4355 60
  K4390 60
  K5142-45 60
  K8233 60
  K9037-38 60
  K44051-52 56

PAGE

  K477989-478000 62
Cleavage:
  Axial planar 50
    Photo 51
  Fracture 54
Contact zone 41
Copper 56
Corrigan option 56
Crossroute Lake 8,19,20,33,55

Diamond-drilling 56,57,60,61
  Drill logs 60
  Drill sites:
    Figure 57
Dikes:
  Agmatite 40
  Aplite 39
  Feldspar porphyry 62
    Gold-bearing 60
  Felsic 36
    Thin section 36
  Felsite 33,55
  Mafic 42
  Pegmatite 39
  Quartz-feldspar porphyry 55
  Stromatite 40
  Wacke:
    Photo 28
Diorite 36
  Amphibole 36
  Quartz 36,39
    Thin section 37
  Thin section 37

Electromagnetic anomalies 56
Endocontact zone 38,54
Esker 43
Esox Lake . . . . . 5,11,25,26,30,33-35, 44-54 *passim*, 60
Esox Lake Stock . . . . . 34,36,47-52 *passim*
Exocontact zone 35,38,39,48,54.55

Fault, Manitou Stretch-Pipestone Lake . 5, 5,7,8,43-52 *passim*, 55,60,62
Feldspar porphyry dike 62
  Gold-bearing 60
Felsic dike 36
  Thin section 36
Felsic flow 61
Felsite dike 33,55
Flame structures:
  Photo 26
Flaser Structure 35,36
Flow breccia, mafic 31
  Photo 13
Flows 8,9
  Andesite:

PAGE

Photos 16,17
Felsic 61
Intermediate:
Thin section 20
Mafic 12,15,32,33,44,47,48,52,56
Thin sections 15
Magnetite-bearing 8
Pillowed 7,8,47,48
Floyd Lake 5,9,44,54
Folds 40
Foliation 10,35
Fracture cleavage 22,54
Furlonge Lake 5,11,30,31,41,44, 48,50,52,55,56
Furlonge Lake Stock 11,49

Gabbro 32,36
Magnetite-bearing 33
Glacial Lake Agassiz 43
Glaciation, Wisconsinan 42
Gneissosity 10
Gold 56,60,61
In feldspar porphyry dike 60
In quartz veins 62
Mineralization 55
Gossan 31,55
Granodiorite 36
Thin section 38
Greenschist facies of metamorphism . . . 15

Harris Lake 36,37,38
Holstein Lake 7,8
Hyaloclastic breccia, mafic:
Photo 14

Jackfish Lake Complex . . . . . . 5,10,11,36, 44,48-55 *passim*

Kaiarskons Lake 39
Konigson Occurrence 57

Lapillistone 35
Lapilli-tuff 7,8,9.11,18,21,32
Lawrence Lake Batholith 5,7,44,49, 54,55
Line Bay 5,10,11,23,31,43,44,48
Loonhaunt River 39
Lou Lake 5,11,12,43,44,47,48,56
Lucy, W. 62

Mafic flows 12,15,32,33,44, 47,48,52,56
Thin section 15
Magnetic anomalies 56
Magnetite 40,42
In chert 55
In flows 8
In gabbro 33
Manitou Rapids 26,27

PAGE

Manitou Stretch . . . 9,16,20,21,22,23,26, 27,30,43,47,49,50,52,54
Manitou Stretch-Pipestone Lake Fault. . 5, 43-52 *passim*, 55,60,62
Metasediments 11
Metasomatism 39,40
Metavolcanics, sheared felsic 21
Migmatite 40
Contact 41
Mineralization, gold 55
Mirror Bay 42
Missus Lake 9,16,21,38,44,50,54
Mister Lake . . . 9,21,22,24,33,44,50,54,60
Mosher vein of Straw Lake Beach Mine . 61
Mudstone:
Cherty:
Photo 29
Photo 27
Mylonite 36

Peat 43
Pegmatite 41
Dikes 39
Peridotite 32
Pillowed flows 7,8,47
Pillows 12,16
Pinch-and-swell structures 36
Pipestone Creek 7,28,29,30,46
Pipestone Lake 10,12,13,25,30,32, 42,46,55,60
Pipestone Lake-Manitou Stretch Fault. . 5, 7,8,43-52 *passim*, 55,60,62
Porphyry 20,33,42
Lenses 21,33
Sheets 21,33
Stocks 34
Thin section 36
Porphyry, quartz-feldspar . . . 34,35,44,49, 53,54,55
Photos 34,53
Projex Ltd. 61
Properties, location of:
Figure 57
Pyrite 31,55,56,60
Pyrite-rich trondhjemite 54
Pyroclastic rocks 8,15
Pyrrhotite 55,56

Quartz diorite 36,39
Thin section 37
Quartz-feldspar porphyry . . . 34,35,44,49, 53,54
Dike 55
Photos 34,53
Quartz monzonite 41
Thin section 41
Quartz veins, gold-bearing 62

Rainy Lake Batholith 5,39,48

PAGE

Rhyolite 22

Schists. 11,47
  Sericite 22,23
Schistosity 10,34,49,61
Seahorse Lake. 5,25-27,33,34,
  40-33 *passim*, 47,50
Sericite 24,36,39
Shaft. 57,60
Shearing 23,43,48
  Zones 8.15
Sills, ultramafic. 32
Siltstone 28
Silver 61
South Yoke Lake Syncline 45
Straw Lake Beach Mine 21-24,62
Straw Lake Mining Syndicate. 62
Straw Lake Occurrence. 54,60
Stromatite dikes 40
Structural features:
  Figure. 45
Sucan Creek 25,46
Sucan Lake 5,10,11,20,23,25,
  40-36 *passim*, 42,47-50
Sullivan Lake 8,17,22,36,37,
  45,49,55,56
Sullivan Lake Anticline. 44,45
Sulphide minerals:
See: Arsenopyrite; Chalcopyrite; Pyrite;
  Pyrrhotite.
Surveys:
  Airborne electromagnetic 60
  Ground magnetometer 56
  Magnetic 60
Syenogabbro 39
Sylvanite Gold Mines Ltd. 57
Synclines 25
  South Yoke Lake 45
  Thompson Bay 12,53
  Yoke Lake 9,15,16,44,45,49

Thin sections 39,41
  Biotite granite. 40
  Crystal tuff 21
  Diorite 37
  Felsic dike 36
  Flows 20
    Mafic 15
    Massive 24
  Granodiorite. 38
  Porphyry 36
  Pyroclastic rocks 24
  Quartz diorite. 37
  Quartz monzonite 41
  Wacke 30
Thompson Bay . . . . 5-14 *passim*,
  20-30 *passim*, 44-53 *passim*
Thompson Bay anticline 10,20,47,48
Thompson Bay antiform. 23,46,53
Thompson Bay syncline 12,53
Trondhjemite 8,33,36,38,39,50
  Pyrite-rich 54
Tuff 7,11,32
  Breccia 21
  Crystal:
    Thin section 21
Tuffaceous wacke 11
Tuff-breccia 7,8,9,11,18,19
  Photo 18

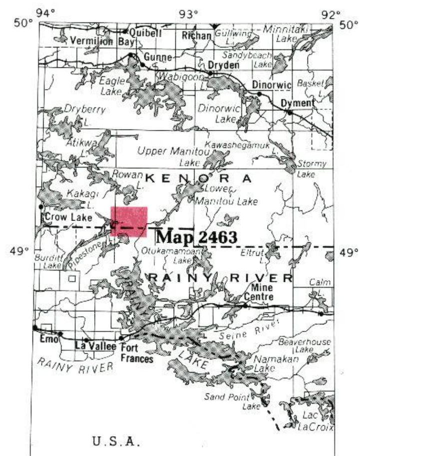
Veins:
  Gold-bearing quartz 62
  Mosher (Straw Lake Beach Mine) . . . 61
  Sulphide 61

Wacke 28
  Dike:
    Photo 28
  Photo 27
  Thin sections 30
  Tuffaceous. 11
Wisconsinan glaciation 42

Yoke Lake. . . . 5,8,9,15-22,31-37 *passim*,
  45,49,50,55
Yoke Lake Syncline. . . . 9,15,16,44,45,49

Ministry of Natural Resources
Ontario

Ontario Geological Survey
Map 2463
Straw Lake



Scale 1 inch to 50 miles
N.T.S. Reference 52 F/3

LEGEND

PHANEROZOIC

CENOZOIC[a]

QUATERNARY

PLEISTOCENE AND RECENT

Till, lacustrine clay, sand, raised beach deposits, alluvium.

UNCONFORMITY

PRECAMBRIAN[b]

EARLY PRECAMBRIAN (ARCHEAN)

LATE MAFIC INTRUSIVE ROCKS

12
- 12a Unsubdivided.
- 12b Amphibole (pyroxene) porphyry.
- 12c Equigranular, biotite-actinolite gabbro.
- 12d Biotite lamprophyre.

INTRUSIVE CONTACT

FELSIC INTERMEDIATE AND MAFIC INTRUSIVE ROCKS

ESOX AND FURLONGE LAKE STOCKS

11
- 11 Unsubdivided.
- 11a Leucocratic quartz monzonite and granite.
- 11b Porphyritic quartz monzonite.
- 11c Agmatic and stromatic contact migmatite.

INTRUSIVE CONTACT

JACKFISH LAKE COMPLEX

10
- 10 Unsubdivided.
- 10a Hornblende syenodiorite.
- 10b Porphyritic hornblende syenodiorite.
- 10c Porphyritic quartz monzonite.
- 10d Stromatic and agmatic contact migmatite.
- 10e Aplite, pegmatite.
- 10f Leucocratic biotite trondhjemite.

INTRUSIVE CONTACT

LAWRENCE LAKE BATHOLITH

9
- 9 Unsubdivided.
- 9a Mixed contact phase.[c]
- 9b Biotite-hornblende diorite.
- 9c Biotite-hornblende quartz diorite.
- 9d Actinolite diorite.
- 9e Granodiorite.
- 9f Trondhjemite.
- 9g Gabbro and ultramafic rocks.
- 9q Porphyritic dikes.
- 9t Aplitic and felsite dikes.
- 9v Inclusions.

INTRUSIVE CONTACT

SUBVOLCANIC ROCKS

ESOX LAKE PORPHYRY

8
- 8 Unsubdivided.
- 8a Biotite-feldspar-quartz porphyry.
- 8b Biotite-quartz-feldspar porphyry.
- 8c Brecciated, autobrecciated.[d]
- 8d Cataclastic breccia, sericite schist, phyllonite.

DIKE ROCKS

7
- 7a Unsubdivided.
- 7b Quartz-feldspar porphyry.[e]
- 7c Feldspar porphyry.[e]
- 7d Amphibole (chlorite)-quartz-feldspar porphyry.
- 7e Felsite.[e]
- 7f Leucocratic biotite trondhjemite.
- 7g Carbonate-sericite schist.
- 7h Carbonatized.

INTRUSIVE CONTACT

METAMORPHOSED MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

6
- 6a Peridotite (dunite in part).
- 6b Pyroxenite.
- 6c Gabbro.
- 6d Quartz-amphibole gabbro.
- 6e Leucocratic gabbro, gabbroic anorthosite.
- 6f Ophitic, knobby gabbro.
- 6g Porphyritic (plagioclase) gabbro.
- 6h Serpentinized.
- 6j Carbonatized.
- 6k Schistose.
- 6m Amphibolite.
- 6n Magnetite-bearing.
- 6p Talcose.

INTRUSIVE CONTACT

METAVOLCANICS AND METASEDIMENTS

CHEMICAL METASEDIMENTS

5
- 5a Chert.
- 5b Ferruginous chert.
- 5c Iron formation.

CLASTIC METASEDIMENTS

4
- 4a Unsubdivided.
- 4b Medium-to coarse-grained arkosic wacke.
- 4c Fine-grained arkosic wacke.
- 4d Siltstone, mudstone.
- 4e Mainly thick-bedded.
- 4f Mainly medium-bedded.
- 4g Mainly thin-bedded.
- 4h Laminated.
- 4j Flames, load casts.
- 4k Conglomerate, pebble and granule.
- 4m Tuffaceous.
- 4n Green tuffwacke.
- 4p Schist, phyllite, slate.
- 4q Carbonatized.
- 4r Cherty.
- 4s Graphitic regolith-like conglomerate.
- 4t Graphitic.

FELSIC METAVOLCANICS

3
- 3a Unsubdivided.
- 3b Flow.
- 3c Fragmental.
- 3d Tuff-breccia.
- 3e Lapilli-tuff.
- 3f Tuff.
- 3g Flow banding.
- 3h Carbonatized.
- 3j Sericite schist.[f]

INTERMEDIATE METAVOLCANICS

2
- 2a Unsubdivided.
- 2b Flow.
- 2c Tuff-breccia.
- 2d Agglomeratic tuff-breccia.
- 2e Lapilli-tuff.
- 2f Tuff, crystal tuff.
- 2g Chlorite-sericite schist.
- 2h Carbonatized.
- 2j Porphyritic.
- 2k Metasomatized.
- 2m Andesitic composition.

MAFIC METAVOLCANICS

1
- 1a Flow (unsubdivided).
- 1b Pillowed flow.
- 1c Amygdaloidal flow.
- 1d Variolitic flow.
- 1e Massive flow.
- 1f Coarse-grained flow.[g]
- 1g Porphyritic flow.
- 1h Flow breccia.
- 1j Pillow breccia, hyaloclastic breccia, aquagene tuff.
- 1k Tuff-breccia, agglomeratic tuff-breccia.
- 1m Lapilli-tuff.
- 1n Tuff.
- 1p Chlorite schist.
- 1q Magnetite, garnet, biotite, feldspar, hornblende schist and gneiss.
- 1r Amphibolite.
- 1s Carbonatized.
- 1t Magnetite-bearing.
- 1u Hornfelsed flow.
- 1v Metasomatized.
- 1w Andesitic composition.

Ag	Silver.
asp	Arsenopyrite.
Au	Gold.
Cu	Copper.
gf	Graphite.
po	Pyrrhotite.
py	Pyrite.
qv	Quartz vein.

---

[a]Unconsolidated deposits. Cenozoic deposits are represented by the lighter coloured parts of the map.

[b]Bedrock geology. Outcrops and inferred extensions of each rock unit are shown respectively in deep and light tones of the same colour.

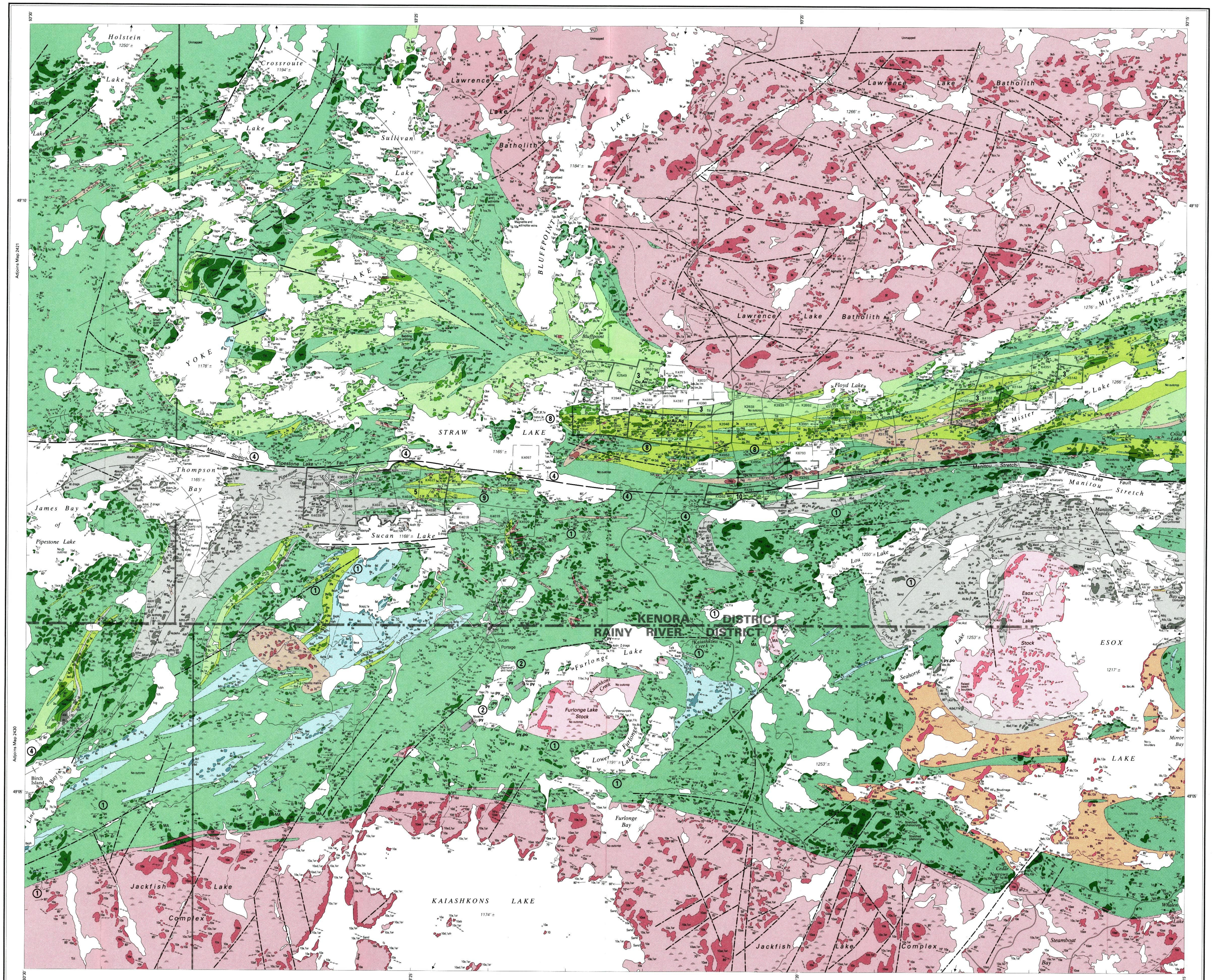
[c]Contains some metasomatized volcanic rocks.

[d]May be protoclastic.

[e]May be volcanic in part, especially west of Mister Lake.

[f]May be subvolcanic dikes in part.

[g]May be intrusive in part.



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SYMBOLS

- Glacial striae. Glacial fluting or drumlin.
- Esker.
- Bedrock; (small outcrop, area of outcrop).
- Bedding, horizontal.
- Bedding, top unknown; (inclined, vertical).
- Bedding, top indicated by arrow; (inclined, vertical, overturned).
- Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).
- Bedding, top (arrow) from cross bedding; (inclined, vertical, overturned).
- Bedding, top (arrow) from relationship of cleavage and bedding; (inclined, overturned).
- Lava flow; top (arrow) from pillows shape and packing. Lava flow; top in direction of arrow.
- Direction of paleocurrent.
- Schistosity; (horizontal, inclined, vertical).
- Gneissosity; (horizontal, inclined, vertical).
- Foliation; (horizontal, inclined, vertical).
- Banding; (horizontal, inclined, vertical).
- Lineation with plunge.
- Geological boundary; (observed, position interpreted, deduced from geophysics).
- Magnetic contour value in gammas. Magnetic attraction.
- Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.
- Lineament.
- Jointing; (horizontal, inclined, vertical).
- Drag folds with plunge.
- Anticline, syncline, with plunge.
- Drill hole; (vertical, inclined, projected vertically, projected up dip). Overburden shown.
- Location of sample.
- Vein, vein network. Width in inches or feet.
- RA Radioactivity.
- Swamp.
- Motor road. Provincial highway number encircled where applicable.
- Other road. Trail, portage, winter road.
- International or Provincial boundary.
- County, District, Regional or District Municipal Boundary, with mile post.
- Municipal Boundary, (City, Town, Improvement District, Incorporated Township), with milepost.
- Township, Indian Reserve, Meridian, Base Line, Provincial Park, with milepost, (surveyed, unsurveyed).
- Mining property, surveyed. Mineral deposit or mining property, unsurveyed.
- Surveyed line. Unsurveyed line.

All boundary and survey lines are approximate position only.

Some symbols may not occur on this map.

Ontario Geological Survey

Map 2463

STRAW LAKE

KENORA and RAINY RIVER DISTRICTS

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

GEOGRAPHIC NAMES

1. The name "Manitou Rapids" is not approved by the Ontario Geographic Names Board (OGNB). It is used on this map as a reference point.
2. The OGNB approves the spelling of "Kaiashkons Lake" as shown on this map. Ontario Geological Survey (OGS) report 222 shows this name as "Kaiarskons Lake".
3. Similarly the OGNB approves the names "Kaiashkons Creek" and "Lower Furlonge Lake" which appear in OGS report 222 as "Loonhaunt River" and "Bending Lady Lake" respectively.

PROPERTIES, MINERAL OCCURRENCES

1. Canadian Nickel Company Limited.
2. Conwest Exploration Company Limited [1952].
3. Eustace, A.J.
4. Freeport Canadian Exploration Company [1971].
5. Mathiew, J.A., Estate.
6. McKay, G.H.
7. Minedel Mines Limited (Straw Lake Beach Mine).
8. Projex Limited.
9. Straw Lake Occurrence [1934?].
10. Viger, S.J., Property.

Information current to December 31, 1975. Former properties on ground now open for staking are only shown if exploration data is available. A date in square brackets indicates last year of exploration activity. For further information see report.

SOURCES OF INFORMATION

Geology by G.R. Edwards and R.H. Sutcliffe and assistants, Ontario Geological Survey, 1976.

Geology is not tied to surveyed lines.

Resident Geologist's Files, Ontario Ministry of Natural Resources, Kenora.

Published maps and reports of the Ontario Geological Survey, Ministry of Natural Resources.

Preliminary map (OGS), P. 1243, Straw Lake Area, scale 1 inch to ¼ mile, issued 1977.

Location of small private lots not shown may be obtained from the Surveys and Mapping Branch, Ministry of Natural Resources, claim maps M2430 and M2471, scale 1 inch to 40 chains.

Cartography by D.J. Laroche and assistants, Surveys and Mapping Branch, 1983.

Basemap derived from maps of the Forest Resources Inventory, Surveys and Mapping Branch, with additional information by G.R. Edwards.

Magnetic declination in the area was approximately 6°15′ East, in 1975.

Edwards, G.R. and Sutcliffe, R.H.
1984: Straw Lake; Ontario Geological Survey Map 2463, Precambrian Geology Series, scale 1 inch to ½ mile. Geology 1976.