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Report 199

Geology of the

Burntbush-Detour Lakes Area

District of Cochrane

By

G.W. Johns

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1000-300-80-Thorn

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(back pocket)

Map 2453 (coloured)–Burntbush-Detour Lakes Area, Cochrane District. Scale 1:100 000.

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 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
			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.

ABSTRACT

This report describes the geology, mineral deposits, and exploration history of a region bounded by Latitudes 49°00'N and 50°04'N and the Quebec border and Longitude 80°00'W, an area of 4030 square kilometres north of Lake Abitibi. The centre of the map-area is 169 km northeast of Timmins.

The area is underlain by metavolcanics, metasediments, and igneous intrusive rocks of Precambrian age, but the majority of the area is covered by Pleistocene till and Recent swamp deposits.

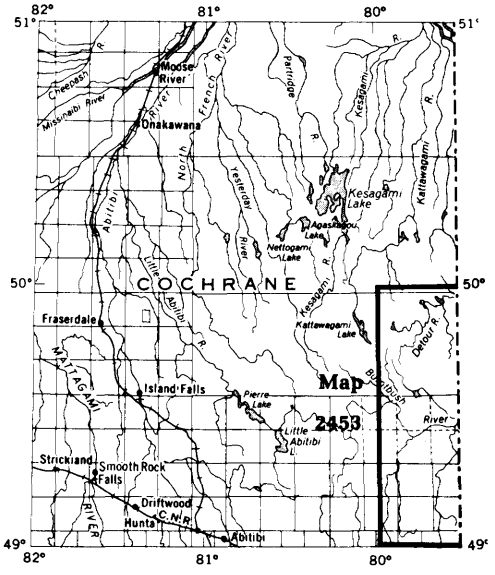

Figure 1–Key map showing location of Burntbush-Detour Lakes area. Scale 1:3 168 000 (1 inch to 50 miles).

The oldest rocks are Early Precambrian (Archean) metavolcanics and metasediments. The metavolcanics are subdivided into mafic to intermediate and felsic to intermediate compositions. The mafic to intermediate metavolcanics are generally amphibolitized and consist of flows, pillowed flows with autoclastic breccia, porphyritic flows, and lapilli to pyroclastic breccia. These are overlain by the felsic to intermediate metavolcanics composed of tuffs, lapilli-tuff, tuff-breccia, and pyroclastic breccia with minor flow material. In the south, clastic metasediments overlie the majority of the metavolcanics whereas in the north they underlie them. Wacke turbidites are the common metasediment whereas only minor iron-rich chemical metasediments are found exposed or geophysically interpreted. The metavolcanics and metasediments are intruded by synchronous gabbro and diabase. These rocks have been metamorphosed to almandine-amphibolite facies and intruded by Early Precambrian batholiths and stocks of quartz monzonite, granodiorite, diorite, and trondhjemite. All of these rocks have been intruded by Late Precambrian (Proterozoic) quartz diabase.

The metavolcanic and metasedimentary rocks lie at or within the noses of two fold structures which extend west from the main body of the Abitibi volcanic belt in Quebec. The southern belt is basically an antiform produced by the doming effect of the emplacement of the felsic to intermediate intrusive rocks. The northern belt contains a main anticline with associated series of synforms and antiforms. No major faults or lineaments have been proposed.

The map-area has been subjected to intense exploration for base metals since 1974. During the search for base metals gold was discovered north of Detour Lake. Ten million tons grading approximately 6.86 ppm gold was outlined within the mafic to intermediate metavolcanics. An interbedded ironstone, chert, wacke sequence in southeastern Kenning Township was calculated to have 25 percent iron and a tonnage of 133,000 tons per vertical metre. A spodumene-bearing pegmatite was described south of Little Joe Lake in Steele Township. A low grade copper-nickel prospect has been outlined in St. Laurent Township within the mafic to intermediate metavolcanics.

Continued exploration is recommended for the felsic to intermediate metavolcanics found in the map-area. All mineralized diamond drill core should be assayed for gold.

Geology of the

Burntbush-Detour Lakes Area

District of Cochrane

By

G.W. Johns[1]

INTRODUCTION

Location

The map-area is bounded by Latitudes 49°00′ and 50°04′N and the Quebec border and Longitude 80°00′W and comprises 4030 square kilometres in northeastern Ontario. The map-area includes the Townships of Bradette, Noseworthy, St. Laurent, Hurtubise, Clive, Singer, Adair and Abbotsford. Parts of Hepburn, Scapa, Steele, Case, Kenning, Tomlinson, and Hoblitzel Townships are also within the map-area. That part of the map-area which includes the surveyed and unsurveyed townships are in the Larder Lake Mining Division and the unsubdivided part to the north is in the Porcupine Mining Division. The map-area is north of Lake Abitibi and its centre is 169 km northeast of Timmins.

Access

The southern part of the map-area is crossed by the Abitibi Paper Company Limited's trans-limit road. The trans-limit road connects with Highway 652 from Cochrane and connects directly with the mill in Iroquois Falls. By road Cochrane and Iroquois Falls are 93 km and 95 km respectively west of the map-area. La Sarre, Quebec is 63 km east via the trans-limit road connecting with the highway through St. Lambert Desmeloizes, Quebec. Connecting with the trans-limit road are networks of auxillary haulage roads and feeder roads.

[1]Geologist, Ontario Geological Survey, Precambrian Geology Section, 77 Grenville St., Toronto, Ont., M5S 1B3. Manuscript approved for publication by the Chief, Precambrian Section, October 17, 1979. This report is published with the permission of E.G. Pye, Director, Ontario Geological Survey.

The haulage roads presently in use are in Scapa, Case, and Kenning Townships. The farthest north one may drive is the Patten River in the southern part of St. Laurent Township. North of the Patten River these roads are in unknown condition and are only accessible by roads through Adair Township from St. Ephrem de Paradis, Quebec, since the bridge crossing the Patten River is gone. The haulage and feeder roads not presently in use are in various stages of disrepair and may or may not be passable.

The northern part of the map-area may be reached by float-equipped aircraft and helicopter from Timmins and float-equipped aircraft from both Cochrane and La Sarre, Quebec. From Cochrane and La Sarre it is 134 km and 131 km respectively to Detour Lake in the north-central part of the map-area. From Detour Lake to Timmins it is 200 km.

Natural Resources

The map-area lies within the Boreal Forest Region and is subdivided into two subsections; the Northern Clay and the Hudson Bay Lowlands (Rowe 1972). The Northern Clay Subsection has large stretches of black spruce, which cover the gently rising ground as well as the lowland flats, where the trees alternate with extensive sedge and sphagnum moss swamps. Better drained areas contain mixed stands of white birch, poplar, and white and black spruce. Stands of jack pine are found on outwash deposits, old beaches, and eskers. The Hudson Bay Lowlands Subsection has an open woodland appearance of black spruce and tamarack interspersed with numerous muskeg swamps. The better drained areas along riverbank levees, have white spruce, balsam fir, poplar, and white birch.

The Abitibi Paper Company Limited has been harvesting the black spruce from the southern part of the map-area for the past two to three decades. Clear cutting has occurred in Clive, Adair, Abbotsford, Case, Steele, and Scapa Townships. Current cutting is underway in northern Case Township and southern Kenning Township.

Pike and pickerel are the most common fish found in most lakes and streams. Brook trout has been reported in the smaller rivers in the southern part of the map-area and in the fast-moving waters of the Burntbush and Patten Rivers. Lindberg Air services in Cochrane maintain an outpost camp on Detour Lake.

Moose and bear are abundant and cariboo were seen occasionally by members of the field party. Beaver, wolf, rabbit, weasel, red fox, skunk, and grouse were identified by sight or spoor.

Topography and Drainage

Except for the southern half, the map-area is flat and swampy with an average elevation of 300 m. In the south, the more abundant outcrop form topographic highs in the form of ridges. The Steele ridge has a maximum elevation of 423 m above sea level south of Little Joe Lake and decreases in elevation to

the east and west. The granite hill north of Joe Lake in Adair Township has an elevation of 400 m above sea level. The most rugged part of the map-area is the large outcrop area in Hurtubise and St. Laurent Townships. The elevation is about 423 m above sea level and widely spaced, deeply eroded, joints have given the hills a stepped nature. In Kenning, Abbotsford, Adair, and Hepburn Townships the outcrops form southeast- to east-trending ridges with a maximum elevation of about 50 m above the surrounding ground, the ridges are interspersed with poorly drained Pleistocene deposits. The outcrop in the rest of the map-area is in the form of knolls within the extensive muskeg.

Throughout the map-area the drainage is poor as characterized by the abundance of muskeg swamps. A large part of the map-area is drained by the Burntbush-Turgeon-Harricanaw river system which flows into southern James Bay. The northwestern part of the area is ultimately drained by the Kattawagami River. The extreme southwestern part of the area drains into Lake Abitibi and hence into the Abitibi River system into James Bay. The Burntbush River, Patten River, and most of the Kabika River are suitable for transportation by canoe with a minimum of portages.

Previous Geological Investigations

The areas within and surrounding the map-area have been subject to previous geological surveys dating back to 1914. T.L. Tanton (1919) mapped the eastern edge of the area in 1914 and 1915. In the fall of 1917, Percy E. Hopkins (1918) undertook a track survey of the La Rein (Okiodosik) and Patten Rivers. Robert Thomson (1936) completed a reconnaissance geological survey of the Burntbush River area in 1934. The townships of Steele, Bonis, and Scapa were mapped by S.B. Lumbers (1962) at a scale of 1 inch to ¼ mile (1:15 840) in 1959. Hepburn Township and parts of Sargeant, Adair, and Abbotsford were mapped by Lumbers (1963) in 1960 at the same scale. Lumber's work was incorporated into the present survey. In 1966 G. Bennett *et al.* (1967) mapped 71,680 km^2 which included the entire Burntbush-Detour Lakes Area. The Twopeak Lake area, adjacent to a part of the western boundary of the present survey, was mapped in 1976 (Wilson 1979).

Present Geological Survey

Field work for this report was undertaken between May 29 and August 24, 1978. The crew consisted of the author, one senior assistant, and three junior assistants.

Mapping was done using air photographs with a scale of 1 inch to ¼ mile (1:15 840), taken in 1961 and 1971 and provided by the Airphoto Library, Ministry of Natural Resources. Mapping was also done using air photographs with a scale of approximately 1:50 000 supplied by the National Airphoto Library, Department of Energy, Mines and Resources, Ottawa. The 1:15 840 photographs only covered the outcrop areas that were delineated by Operation Kapuskasing (Bennett *et al.* 1967). The 1:50 000 photographic coverage was for

the entire map-area. Outcrop geology and boundaries of outcrop areas were plotted in the field on acetate overlays to the air photographs; the data were transferred to Forest Resources Inventory maps (scale 1 inch to ¼ mile or 1:15 840) of the Timber Branch of the Ontario Ministry of Natural Resources. The F.R.I. maps were then photographically reduced in Toronto to a scale of 1:50 000 and the information contained was transferred to the base maps prepared by the Cartography Section, Surveys and Mapping Branch, Ontario Division of Lands at a scale of 1:50 000 from reductions of Forest Resources Inventory maps.

Steele, Scapa, Hepburn Townships, and parts of Adair and Abbotsford Townships previously mapped by Lumbers (1962; 1963) were not remapped by the present field party but major rock types and important relationships were examined. Since the outcrop density in the rest of the map-area is less than 10 percent an attempt was made to visit as many of the outcrops, outlined by Operation Kapuskasing (Bennett *et al.* 1967) and as many of the outcrops discovered by the field party as possible. Outcrop groups were examined using pace-and-compass methods and isolated outcrops were visited using a helicopter. Geology is not tied to surveyed lines. The geology in areas without rock exposure was interpreted using diamond drill logs from the Assessment Files Research Office, Ontario Geological Survey, Toronto and ODM-GSC (1963a,b,c,d,e), 1 inch to 1 mile (1:63 360) aeromagnetic maps.

The helicopter was used in deploying traverse crews in areas without road access and for examining individual, isolated outcrops. The party used a Bell G-4 helicopter for part of the summer and a Bell G-2 for the remainder.

Acknowledgments

The author was assisted in the field by Anna Bivi, David Graham, and Belinda Skelly as junior assistants. W. Motley did some independent traversing.

The help and co-operation of the staff members of the Ministry of Natural Resources in Cochrane, the Timmins Fire Centre and the Regional Geologist's Office is acknowledged and their end of season support is greatly appreciated. The road and cutting limit map supplied by the Abitibi Paper Company in Iroquois Falls aided in the geological mapping in the south. The patience of the Abitibi personnel in Commuter Camp 8 at the end of the field season is appreciated.

The logistical and moral support supplied by W.J. (Bill) Blahey, Timmins, was appreciated. The accommodation and hospitality at the Detour Lake Mine site supplied by Don Deem, Senior Mining Engineer of Amoco Canada Petroleum Company Limited are gratefully acknowledged; the efforts of Germain Gagnon and Richard Legault of the J.S. Redpath Company were greatly appreciated by the field crew. The information, obtained by the author, from discussions with Paul Brown, Geologist, Amoco Canada Petroleum Company Limited was very helpful in the final interpretation of the map and is hereby acknowledged.

Personnel of Ranger Lake Helicopters of Sault Ste. Marie assisted in the performance of the field work. Serving as pilots during the summer were Marty Sinclair from Sault Ste. Marie and David Brooks from Pickle Lake.

The author would like to acknowledge the assistance extended by Dale Pyke, subsection leader, Ontario Geological Survey during the preparation of this report.

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Prospecting and Mining Activity

A gold discovery was reported on the Patten River in 1912 (Tanton 1919). The subsequent rush of prospectors failed to find any valuable deposits. Exploration activity has been sporadic since 1925 with increases in the late 1950s, mid 1960s, and recommencing in the early 1970s. Exploration has increased since 1974 with the announcement of a gold discovery by Amoco Canada Petroleum Company Limited north of Detour Lake.

The initiation of prospecting activity in 1925 was due to the discovery of copper-zinc mineralization at Normetal, Quebec. The rocks that appeared to be most favourable for prospecting for base metals at that time were the metavolcanics in Adair Township which are structurally and lithologically similar to those exposed at the Normetal Mine. Exploration, however, has failed to discover any mineral deposits. Also examined were the mafic metavolcanics in Steele Township. In the early 1930s Cyril Knight prospected for gold on a group of claims along the Burntbush River (Thomson 1936).

Much assessment work has been filed with the Assessment Files Research Office, Ontario Geological Survey, Toronto since 1957 (see Table 1). Recently the exploration for base metals has been concentrated in: a) the isoclinally folded sequence of felsic to intermediate, mafic to intermediate metavolcanics, and iron-rich metasediments in Adair and Abbotsford Townships; b) the felsic to intermediate metavolcanics in Bradette, Noseworthy, and Hurtubise Townships; and c) the interbedded felsic to intermediate, mafic to intermediate metavolcanics, and metasediments in the vicinity of Vandette and Atkinson Lakes. Three deposits of economic interest have been discovered within the map-area. 1) In Steele Township a spodumene-bearing pegmatite has been assessed for its lithium and is held by Dex Limited. 2) A low-grade copper-nickel deposit was discovered in St. Laurent Township by Asarco Exploration Company of Canada. 3) In the Sunday Lake area Amoco Canada Petroleum Company Limited has outlined 10 million tons of 0.2 ounces per ton gold (a value of $39.78 U.S. per ton as of the price of gold November 1978).

During the field season the following companies and individuals held claims within the map-area: Amoco Canada Petroleum Company Limited, Asarco Exploration Company of Canada, C. Bertrand, G. Brissette, Dex Limited, Dome Exploration (Canada) Limited, Geophysical Engineering Limited, Hollinger Mines Limited, Hudson Bay Exploration and Development Company Limited, D. Maillet, and Noranda Exploration Company Limited.

TABLE 1 | ASSESSMENT WORK FOR THE BURNTBUSH-DETOUR LAKES AREA. (ASSESSMENT FILES RESEARCH OFFICE, ONTARIO GEOLOGICAL SURVEY, TORONTO)

Date	Company	File[1]	Township or Area of Work	Type of Work	Description
1965	Canadian Superior Explor. Ltd.	63.1831	Abbotsford	geophys	airborne surv, ground, EM, mag and gravity
1965	Canadian Javelin Ltd.	63.1731	Abbotsford	geophys	airborne surv
1975	Dome Explor. (Can) Ltd.	2.1973	Abbotsford	geophys	airborne surv, ground mag, EM
1972	Stanford Mines Ltd.	2.1325	Abbotsford	geophys	ground mag, EM
1965	Canadian Superior Explor. Ltd.	63.1833	Abbotsford	geophys geology	ground mag, EM, gravity, geological, grid mapping
1965	Canadian Superior Ex. Ltd.	DDH rpt 10	Abbotsford	DDH	4 holes, 467 m
1965	Canadian Superior Explor. Ltd.	DDH rpt 11	Abbotsford	DDH	3 holes, 108 m
	Canadian Superior Explor. Ltd.	DDH rpt 12	Abbotsford	DDH	1 hole, 127 m
1973	Stanford Mines Ltd.	DDH rpt 13	Abbotsford	DDH	3 holes, 360 m
1976-77	Dome Ex. (Can) Ltd.	DDH rpt 14	Abbotsford	DDH	18 holes, 2107 m
1965	Canadian Superior Explor. Ltd.	62.1856	Adair	geophys	airborne surv, ground EM, mag
1965	Canadian Javelin Ltd.	63.1731	Adair	geophys	airborne surv
1965	Canadian Superior Explor. Ltd.	63.3031	Adair	geophys	airborne surv, ground EM, mag
1965	Canadian Javelin Ltd.	63.1981	Adair	geophys geology	airborne surv, ground EM, mapping
1965	Canadian Javelin Ltd.	DDH rpt 10	Adair & Abbotsford	DDH	14 holes, 1283 m
1977	Dighem Syndicate	DDH rpt 11	Adair	DDH	1 hole, 157 m
1966	Silverplace Mines Ltd.	63.2023	Adair	geophys	ground mag EM
1976	Falconbridge Nickel Mines Ltd.	2.2320	Bradette	geophys	ground mag EM
1974	Noranda Explor. Co. Ltd.	2.1565	Bradette	geophys	ground mag EM
1974	Noranda Explor. Co. Ltd.	2.1638	Bradette	geophys	ground mag EM
1973-74	Noranda Explor. Co. Ltd.	2.1661	Bradette	geophys	ground mag EM
1974	Noranda Explor. Co. Ltd.	2.1761	Bradette	geophys	ground mag EM
1975	Ogryzlo, S.P.	2.2018	Bradette	geophys	ground mag EM
1966	Rio Tinto Canadian Explor. Ltd.	63.2100	Bradette	geophys	ground mag EM, gravity
1965	Rio Tinto Canadian Explor. Ltd.	DDH rpt 10	Bradette	DDH	1 hole, 121 m
1965	Onshore Petroleums Ltd.	DDH rpt 11	Bradette	DDH	3 holes, 637 m
1974	Dome Explor. (Can.) Ltd.	DDH rpt 12	Bradette	DDH	1 hole, 92 m
1974	Dome Explor. (Can.) Ltd.	DDH rpt 13	Bradette	DDH	2 holes, 245 m

Table 1 continued

Date	Company	File[1]	Township or Area of Work	Type of	Description
1975	Dome Explor. (Can.) Ltd.	DDH rpt 14	Bradette	DDH	2 holes, 824 m
1976	Noranda Explor. Co. Ltd.	DDH rpt 15	Bradette	DDH	1 hole, 85 m
1977	Noranda Explor. Co. Ltd.	DDH rpt 16	Bradette	DDH	1 hole, 122 m
1975-76	Dome Explor. (Can.) Ltd.	2.2102	Case	geophys	ground mag & EM
1966	Silverplace Mines Ltd.	63.2023	Hepburn	geophys	ground mag & EM
1974	Noranda Explor. Co. Ltd.	2.1641	Hoblitzel	geophys	ground mag & EM
1976	Noranda Explor. Co. Ltd.	DDH rpt 10	Hoblitzel	DDH	1 hole, 102 m
1976	Geophysical Eng. Ltd.	DDH rpt 11	Hoblitzel	DDH	1 hole, 76 m
1977	Hudson Bay Explor. & Development Co. Ltd.	2.2527	Hurtubise	geophys	ground mag EM
1966	Mowat, J.R.	62.1982	Hurtubise	geophys	ground mag EM
1973-74	Noranda Explor. Co. Ltd.	2.1637	Hurtubise	geophys	ground mag EM
1973-74	Noranda Explor. Co. Ltd.	2.1646	Hurtubise	geophys	ground mag EM
1973-74	Noranda Explor. Co. Ltd.	2.1663	Hurtubise	geophys	ground mag EM
1969	United States Smelting, Refining & Mining Co.	63.2558	Hurtubise	geophys	ground mag EM
1965	Rio Tinto Canadian Explor. Ltd.	DDH rpt 10	Hurtubise	DDH	1 hole, 91 m
1966	Mowat, J.R.	DDH rpt 11	Hurtubise	DDH	1 hole, 106 m
1971	Canadian Superior Explor. Ltd.	DDH rpt 12	Hurtubise	DDH	2 holes, 442 m
1966	Mowat, J.R.	DDH rpt 13	Hurtubise	DDH	1 hole, 106 m
1974	Dome Explor. (Can) Ltd.	DDH rpt 14	Hurtubise	DDH	3 holes, 261 m
1965	Canadian Superior Explor. Ltd.	63.2018	Kenning	geophys	ground mag EM
1976	Hudson Bay Explor. & Development Co. Ltd.	2.2396	Kenning	geophys	ground EM
1976	Hudson Bay Explor. & Development Co. Ltd.	2.2407	Kenning	geophys	ground EM
1966	Jubilant Creek Mines Ltd.	63.1985	Kenning	geophys geology	ground mag EM
1957	Triana Explor. Ltd.	63.908	Kenning	geophys geology	ground mag, grid mapping
1966	Canadian Superior Explor. Ltd.	DDH rpt 10	Kenning	DDH	1 hole, 119 m
1958	Conwest Explor. Co. Ltd.	63.977	Noseworthy	geophys	ground EM
1973	Dome Explor. (Can.) Ltd.	2.1387	Noseworthy	geophys	ground mag EM
1977	Hudson Bay Explor. & Development Co. Ltd.	2.2527	Noseworthy	geophys	ground EM
1974	Noranda Explor. Co. Ltd.	2.1644	Noseworthy	geophys	ground mag EM
1965	Rio Tinto Can. Explor Ltd.	DDH rpt 10	Noseworthy	DDH	2 holes, 210 m

Table 1 continued

Date	Company	File[1]	Township or Area of Work	Type of Work	Description
1974	Dome Explor. (Can.) Ltd.	DDH rpt 11	Noseworthy	DDH	6 holes, 776 m
1974	Dome Explor. (Can.) Ltd.	DDH rpt 12	Noseworthy	DDH	1 hole, 92 m
1976	Geophysical Egg. Ltd.	DDH rpt 13	Noseworthy	DDH	1 hole, 76 m
1976	Geophysical Eng. Ltd.	DDH rpt 14	Noseworthy	DDH	1 hole, 96 m
1976	Geophysical Eng. Ltd.	DDH rpt 15	Noseworthy	DDH	1 hole, 95 m
1975-76	Dome Explor. (Can.) Ltd.	2.2102	Singer	geophys	ground mag EM
1977	Dome Explor. (Can.) Ltd.	DDH rpt 10	Singer	DDH	3 holes, 262 m
1975-76	Mattagami Lake Mines Ltd.	2.2104	Steele	geophys geology	ground mag EM grid mapping
1957	Geophysical Eng. Ltd.	T-44	Steele	DDH	2 holes, 42 m
1972-73	Dex Ltd.	in Kirkland Lake	Steele	surface explor	trenching & stripping
1973	Darby, Leonard	DDH rpt 12	Steele	DDH	1 hole, 31 m
1970	Asarco Exploration Canada Ltd.	2.387	St. Laurent	geophys geology DDH	ground EM, grid mapping 4 holes, 439 m
1975	Dome Exp. (Canada) Ltd.	2.2367	Tomlinson	geophys	ground mag EM
1974	Noranda Exp. Co. Ltd.	2.1647	Tomlinson	geophys	ground mag EM
1959	Conwest Exp. Co. Ltd.	63.1023	Atkinson Lake	geophys	ground mag EM
1975	Hudson Bay Explor. & Development Co. Ltd.	2.1976	Atkinson Lake	geophys	ground mag EM
1976	Noranda Explor. Co. Ltd.	2.2205	Atkinson Lake	geophys	ground mag EM
1976	Noranda Explor. Co. Ltd.	2.2060	Atkinson Lake	geophys	ground mag EM
1966	Rio Tinto Canadian Explor. Limited	63.1990	Atkinson Lake	DDH	ground mag EM
1959	Selco Explor Co.	DDH rpt 10	Atkinson Lake	DDH	3 holes, 162 m
1959	Conwest Explor. Co. Ltd.	DDH rpt 11	Atkinson Lake	DDH	5 holes, 675 m
1959	Kesagami Syndicate	DDH rpt 12	Atkinson Lake	DDH	2 holes, 181 m
1959	Kesagami Syndicate	DDH rpt 13	Atkinson Lake	DDH	1 hole, 116 m
1959	Kesagami Syndicate	DDH rpt 14	Atkinson Lake	DDH	1 hole, 67 m
1960	Conwest Explor. Co. Ltd.	DDH rpt 15	Atkinson Lake	DDH	2 holes, 185 m
1966	Rio Tinto Canadian Explor. Limited	DDH rpt 16	Atkinson Lake	DDH	2 holes, 54 m
1968	Selco Explor. Co. Ltd.	DDH rpt 17	Atkinson Lake	DDH	1 hole, 178 m

Table 1 continued

Date	Company	File[1]	Township or Area of Work	Type of Work	Description
1968	Selco Explor. Co. Ltd.	DDH rpt 18	Atkinson Lake	DDH	1 hole, 148 m
1970	Dome Explor. (Canada) Ltd.	DDH rpt 19	Atkinson Lake	DDH	1 hole, 364 m
1975	Amoco Canada Petroleum Co. Ltd.	DDH rpt 20	Atkinson Lake	DDH	1 hole, 164 m
1974	Amoco Canada Petroleum Co. Ltd.	DDH rpt 21	Atkinson Lake	DDH	1 hole, 132 m
1974	Amoco Canada Petroleum Co. Ltd.	DDH rpt 22	Atkinson Lake	DDH	4 holes, 821 m
1975	Amoco Canada Petroleum Co. Ltd.	DDH rpt 23	Atkinson Lake	DDH	1 hole, 141 m
1975	Amoco Canada Petroleum Co. Ltd.	DDH rpt 24	Atkinson Lake	DDH	1 hole, 118 m
1975	Amoco Canada Petroleum Co. Ltd.	DDH rpt 25	Atkinson Lake	DDH	1 hole, 185 m
1976	Amoco Canada Petroleum Co. Ltd.	DDH rpt 26	Atkinson Lake	DDH	1 hole, 214 m
1976	Hudson Bay Explor. & Development Co. Ltd.	DDH rpt 27	Atkinson Lake	DDH	1 hole, 182 m
1976	Hudson Bay Explor. & Development Co. Ltd.	DDH rpt 28	Atkinson Lake	DDH	4 holes, 382 m
1976	Amoco Canada Petroleum	2.2139	Hopper L.	geophys	ground mag EM
1975	Noranda Explor. Co. Ltd. Co. Ltd.	2.1833	Hopper L. & Lower Detour Lake	geophys	ground mag EM
1976	Noranda Explor. Co. Ltd.	2.2137	Hopper L. & Lower Detour Lake	geophys	ground mag EM
1972	Penarroya Canada Ltee.	2.823	Hopper L. & Lower Detour Lake	geophys	ground mag EM, gravity
1959	Kesagami Syndicate	DDH rpt 10	Hopper Lake	DDH	1 hole, 82 m
1959	Kesagami Syndicate	DDH rpt 11	Hopper Lake	DDH	1 hole, 36 m
1971	Canadian Nickel Co. Ltd.	DDH rpt 12	Hopper Lake	DDH	1 hole, 105 m
1974	Amoco Canada Petroleum Co. Ltd.	DDH rpt 13	Hopper Lake	DDH	2 holes, 368 m
1976	Amoco Canada Petroleum Co. Ltd.	DDH rpt 14	Hopper Lake	DDH	1 hole, 132 m
1977	Noranda Explor. Co. Ltd.	DDH rpt 15	Hopper Lake	DDH	3 holes, 322 m
1978	Noranda Explor. Co. Ltd.	DDH rpt 16	Hopper Lake	DDH	2 holes, 294 m
1975	Hudson Bay Explor. & Development Co. Ltd.	2.1977	Lower Detour Lake & Atkinson Lake	geophys	ground EM

Table 1 continued

Date	Company	File[1]	Township or Area of Work	Type of Work	Description
1974-75	Noranda Explor. Co. Ltd.	2.1912	Lower Detour Lake	geophys	ground mag EM
1974-75	Noranda Explor. Co. Ltd.	2.1831	Lower Detour Lake	geophys	ground mag EM
1975	Noranda Explor. Co. Ltd.	2.2039	Lower Detour Lake	geophys	ground mag EM
1976	Noranda Explor. Co. Ltd.	2.2259	Lower Detour Lake	geophys	ground mag EM
1975	Noranda Explor. Co. Ltd.	2.2019	Lower Detour Lake & Sunday Lake	geophys	ground mag EM
1976	Noranda Explor. Co. Ltd.	2.2157	Lower Detour Lake	geophys	ground mag EM
1976	Noranda Explor. Co. Ltd.	2.2140	Lower Detour Lake	geophys	ground mag EM
1976	Noranda Explor. Co. Ltd.	2.2100	Lower Detour Lake	geophys	ground mag EM
1976	Noranda Explor. Co. Ltd.	2.2174	Lower Detour Lake	geophys	ground mag EM
1972	Penarroya Canada Ltee.	2.823	Lower Detour Lake & Hopper Lake	geophys	ground mag EM
1959	Conwest Explor. Co. Ltd.	DDH rpt 10	Lower Detour Lake	DDH	1 hole, 151 m
1959	Conwest Explor. Co. Ltd.	DDH rpt 11	Lower Detour Lake	DDH	3 holes, 265 m
1959	Kesagami Syndicate	DDH rpt 12	Lower Detour Lake	DDH	1 hole, 103 m
1959	Kesagami Syndicate	DDH rpt 13	Lower Detour Lake	DDH	1 hole, 161 m
1959	Kesagami Syndicate	DDH rpt 14	Lower Detour Lake	DDH	1 hole, 72
1971	Canadian Nickel Co.	DDH rpt 15	Lower Detour Lake	DDH	1 hole, 115 m
1974	Amoco Canada Petroleum Co. Ltd.	DDH rpt 16	Lower Detour Lake	DDH	2 holes, 331 m
1974-75	Amoco Canada Petroleum Ltd.	DDH rpt 17	Lower Detour Lake	DDH	2 holes, 243 m
1975	Amoco Canada Petroleum Co. Ltd.	DDH rpt 18	Lower Detour Lake	DDH	2 holes, 390 m
1976	Amoco Canada Petroleum Co. Ltd.	DDH rpt 19	Lower Detour Lake	DDH	1 hole, 177 m

Table 1 continued

Date	Company	File[1]	Township or Area of Work	Type of Work	Description
1976	Amoco Canada Petroleum Co. Ltd.	DDH rpt 20	Lower Detour Lake	DDH	2 holes, 409 m
1977	Noranda Explor. Co. Ltd.	DDH rpt 21	Lower Detour Lake	DDH	1 hole, 118 m
1977	Noranda Explor. Co. Ltd.	DDH rpt 22	Lower Detour Lake	DDH	1 hole, 114 m
1977	Noranda Explor. Co. Ltd.	DDH rpt 23	Lower Detour Lake	DDH	1 hole, 161 m
	Amoco Canada Petroleum Co. Ltd.	2.2342	Sunday Lake	Expenditure	receipts, x-sections for selected drill holes along the ore zone
1975	Noranda Explor. Co. Ltd.	2.2175	Sunday Lake	geophys	ground mag EM
1975	Noranda Explor. Co. Ltd.	2.2040	Sunday Lake	geophys	ground mag EM
1975	Noranda Explor. Co. Ltd.	2.2019	Sunday Lake	geophys	ground mag EM
1975	Noranda Explor. Co. Ltd.	2.1911	Sunday Lake	geophys	ground mag EM
1976	Noranda Explor. Co. Ltd.	2.1880	Sunday Lake	geophys	ground mag EM
1975	Noranda Explor. Co. Ltd.	2.1881	Sunday Lake	geophys	ground mag EM
1975	Noranda Explor. Co. Ltd.	2.1879	Sunday Lake	geophys	ground mag EM
1975	Sarafand Dev. Ltd.	2.2076	Sunday Lake	geophys	ground mag EM
1974-75	Amoco Canada Petroleum Co. Ltd.	DDH rpt 10	Sunday Lake	DDH	53 holes, 13 235 m
1974-75	Amoco Canada Petroleum Co. Ltd.	DDH rpt 11	Sunday Lake	DDH	2 holes, 234 m
1974	Amoco Canada Petroleum Co. Ltd.	DDH rpt 12	Sunday Lake	DDH	3 holes, 491 m
1975	Amoco Canada Petroleum Co. Ltd.	DDH rpt 13	Sunday Lake	DDH	1 hole, 320 m
1976	Amoco Canada Petroleum Co. Ltd.	DDH rpt 14	Sunday Lake	DDH	2 holes, 289 m
1974-77	Amoco Canada Petroleum Co. Ltd.	DDH rpt 15	Sunday Lake	DDH	62 holes, 14 281 m
1975	Noranda Explor. Co. Ltd.	2.1807	west of Sunday Lake	geophys	ground mag EM
1975	Ogryzlo, S.P.	2.2006	west of Sunday Lake	geophys	ground mag EM
1971	Canadian Nickel Co. Ltd.	DDH rpt 10	west of Sunday Lake	DDH	1 hole, 145 m
1971	Canadian Nickel Co. Ltd.	DDH rpt 11	west of Sunday Lake	DDH	2 holes, 230 m
1974	Amoco Canada Petroleum Co. Ltd.	DDH rpt 12	west of Sunday Lake	DDH	1 hole, 106 m
1974	Amoco Canada Petroleum Co. Ltd.	DDH rpt 13	west of Sunday Lake	DDH	1 hole, 109 m

GENERAL GEOLOGY

The map-area lies in the northern part of the Early Precambrian Abitibi Belt of the Superior Province at the noses of two folded supracrustal sequences extending west from the main volcanic-sedimentary sequence in Quebec. The metavolcanic and metasedimentary rocks have undergone regional and contact metamorphism, ranging from upper greenschist to almandine-amphibolite facies rank.

The southern belt of supracrustal rocks which is found between the southern map boundary and Latitude 49°35′ appears to be composed of either two volcanic piles which have a common metasedimentary unit or a single, broadly domed sequence. In the southern part the base is composed of interdigitated mafic to intermediate metavolcanics and felsic to intermediate metavolcanics. The mafic component pinches out to the northwest and the felsic component becomes interfingered with a clastic metasediment. The felsic metavolcanics then pinch out farther to the northwest. The overlying, clastic Scapa Metasediments (Lumbers 1962; 1963) are conformable with the metavolcanics. These clastic metasediments contain iron-rich chemical metasediments which can be traced around the western extent of the nose of the fold (Bennett *et al.* 1967) to the northern section of the southern supracrustal belt. Overlying the Scapa Metasediments in Steele Township are the thin, amphibolitic, mafic to intermediate Steele Volcanics, (Lumbers 1962; 1963) which are then overlain by the clastic Steele Metasediments. The Steele Volcanics and Metasediments are only found in the southwestern part of the map-area.

North of the Mistawak Batholith, the base of the metavolcanic sequence is a thick section of mafic to intermediate flows with minor interbedded felsic to intermediate tuffs. Overlying this are the felsic to intermediate metavolcanics with minor interbedded mafic to intermediate metavolcanics and clastic metasediments. These metavolcanics thin and disappear to the west. The lateral equivalent of the Scapa Metasediments cap the sequence.

The southern belt was intruded by the quartz monzonitic to granodioritic Mistawak Batholith and Case Batholith as well as the granodioritic Bateman Lake Pluton and Patten River Pluton and the trondhjemitic Hurtubise Stock. These felsic to intermediate intrusions domed the supracrustal rocks and caused local complications in the structure. Lack of outcrop precludes a detailed description.

The northern supracrustal belt is found from Latitude 49°45′N to the northern map boundary and from the Quebec border to Longitude 79°35′W. This metavolcanic-metasedimentary sequence's lowest unit is interpreted to be felsic to intermediate metavolcanics. This is overlain by a thin clastic metasedimentary unit which in turn is overlain by mafic to intermediate flows and pyroclastics. Interpreted by the author to overlie the mafic metavolcanics is a generalized unit containing in decreasing abundance; interbedded felsic to intermediate metavolcanics, mafic to intermediate metavolcanics, and fine-grained metasediments. This generalized sequence grades laterally to the northwest into metasediments which may have mafic flows. Within this generalized capping sequence, graphitic tuffs and metasediments, commonly with large amounts of associated sulphide mineralization, are common.

TABLE 2 | TABLE OF LITHOLOGIC UNITS FOR THE BURNTBUSH-DETOUR LAKES AREA

PHANEROZOIC

CENOZOIC

QUATERNARY

RECENT

Swamp, stream and lacustrine deposits

PLEISTOCENE

Till, clay, sand, and gravel deposits

Unconformity

PRECAMBRIAN

LATE PRECAMBRIAN (PROTEROZOIC)

MAFIC INTRUSIVE ROCKS

Quartz Diabase

Intrusive Contact

EARLY PRECAMBRIAN (ARCHEAN)

MAFIC TO INTERMEDIATE INTRUSIVE ROCKS

Diorite

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

Quartz monzonite, granodiorite, granite, quartz diorite, feldspar porphyry, quartz-feldspar porphyry, gneiss, pegmatite, felsite, trondhjemite

Intrusive Contact

METAMORPHOSED MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

Gabbro, amphibolite, porphyritic gabbro, ultramafic rocks (not exposed)

Intrusive Contact

METASEDIMENTS

CHEMICAL METASEDIMENTS

Ironstone, chert

CLASTIC METASEDIMENTS

Wacke, arenite, arkose, calc-silicate rocks, grit, fine-grained to very fine grained graphitic metasediments and tuffs, schist

METAVOLCANICS

FELSIC TO INTERMEDIATE METAVOLCANICS

Flow, tuff, lapilli-tuff, pyroclastic breccia, tuff-breccia, porphyryitic flows.

MAFIC TO INTERMEDIATE METAVOLCANICS

Flow, tuff, lapilli-breccia—pyroclastic breccia, amphibolite, pillowed and porphyritic flows, pillow breccia

The northern supracrustal sequence is surrounded by quartz monzonitic batholiths which folded it into a roughly triangular shape. The fold axes within the belt were further warped by the intrusion of the diorite near Detour Lake.

The last magmatic event was the emplacement of diabase dikes which intrude all rock types and cross major structures. These unmetamorphosed dikes have been dated by W.F. Fahrig *et al.* (1965) at 2.485 to 1.230 billion years.

Rock types observed within the map-area are outlined in Table 2.

Precambrian

EARLY PRECAMBRIAN (ARCHEAN)

Metavolcanics

The metavolcanics have been divided on a twofold classification. This was done because of the low outcrop density and extensive use of diamond drill logs for interpretation made a threefold classification impractical. The metavolcanics are divided into mafic to intermediate and felsic to intermediate compositions. In the field this was done by determining the colour index of the rock by observing the weathered rind with a good hand lens. The mafic to intermediate metavolcanics generally have a colour index greater than 25 whereas the felsic to intermediate metavolcanics have a colour index less than 25.

Chemically the metavolcanics are primarily tholeiitic basalt, calc-alkaline rhyolite, and dacite with minor tholeiitic andesite and dacite, and calc-alkaline basalt and andesite. The chemical classification for the rock types was determined using the ternary diagrams of T.N. Irvine and W.R.A. Baragar (1971), (see Figure 2) and L.S. Jensen (1976), (see Figure 3). The chemical analyses and normative calculations are tabulated in Table 3 and the locations for the analyses are in Table 4.

MAFIC TO INTERMEDIATE METAVOLCANICS

There are outcrops of the mafic to intermediate metavolcanics in only four regions of the map-area although they are interpreted to be much more extensive. From south to north they can be found in: Steele Township; Abbotsford, Adair and Hepburn Townships; Kenning, Hurtubise, and St. Laurent Townships; and between Lower Detour, Detour, Hopper, and Sunday Lakes. Minor scattered outcrop is found outside the aforementioned regions.

Common mineral assemblages for the mafic to intermediate metavolcanic rocks are as follows:

hornblende + feldspar + sericite;
hornblende + feldspar + actinolite + biotite + garnet + sericite + epidote;

hornblende + chlorite + feldspar + epidote + sericite + sphene
chlorite + feldspar + sericite + carbonate + epidote.

Amphibolitized massive flows and pillowed flows are the most common lithologic type with minor amounts of tuff, lapilli-tuff, pyroclastic breccia, feldspar porphyry flows, and autoclastic breccia. Individual lithologic types cannot be traced beyond the outcrop on which they occur.

Steele Volcanics

The mafic to intermediate metavolcanics classified by Lumbers (1962) as the Steele Volcanics occur near the southwest corner of the map-area, in a narrow belt, 1500 m wide in the east and 800 m wide in the west, of amphibolitic mafic to intermediate metavolcanics. Lumbers (1962) recognized amygdaloidal, pillowed, massive, diabasic, and porphyritic flows. In addition the author also recognized mafic pyroclastic deposits. A 1 to 3 m thick pale grey garnetiferous, biotite-quartz-feldspar schist was found as an interflow sediment. These individual lithologic types are not extensive enough to be distinguished at the present scale of mapping.

The grain size of the amphibolitized flows of the Steele Volcanics depends on the proximity to the Case Batholith. Grain size varies from fine grained near the Steele Metasediments to coarse grained near the Case Batholith. Colour varies from light grey to dark greenish black. The light colour is due to the abundant development of epidote and feldspar whereas the dark colour is caused by abundant hornblende with minor biotite.

The massive to foliated flows nearer the Case Batholith show indications of mineral banding formed by the segregation of amphiboles and feldspars. Pillows, where seen, are stretched and badly deformed. The porphyritic flows contain about 5 percent of 1 to 2 mm feldspar phenocrysts and are found along the south contact of the metavolcanics with the Steele Metasediments. Carbonate patches are commonly weathered out and may be mistaken for amygdules. Euhedral garnets (<2 mm to 5 to 8 mm) are common. Flow thickness is indicated by a pillowed mafic flow which is bounded by two mafic tuffs, indicating a thickness of approximately 3 to 4 m. Air-fall-tuff breccia is composed of lapilli and bomb size subrounded to subangular clasts in a poorly sorted tuff. The tuff-breccia and tuff horizons are not extensive and pinch out within a few metres.

The principal constituents of the amphibolitic mafic to intermediate metavolcanics in Steele Township are blue-green hornblende, plagioclase, sericite, and garnet with accessory carbonate, sphene, and opaques. Chemical analyses (Table 3) of two samples from these metavolcanics classified them as tholeiitic and calc-alkaline andesites.

Adair Metavolcanics

The mafic to intermediate metavolcanics that occur within Lumber's (1963) Adair Volcanics are interdigitated with the felsic to intermediate metavolcanics. The mafic to intermediate component of the Adair Volcanics can be

TABLE 3: CHEMICAL AND NORMATIVE ANALYSES OF THE METAVOLCANIC ROCKS IN THE BURNTBUSH-DETOUR LAKES AREA

Sample Number	78-11-19	78-11-72	78-11-83	78-11-133	78-11-233	78-11-234
Irvine & Baragar Rock Name	Thole And.	Thole Basalt	Thole Basalt	Calc-alk And. high Al	Calc-alk Basalt high Al	Thole Basalt
SiO_2	50.5	63.0	48.4	60.9	56.3	49.3
Al_2O_3	16.3	12.5	14.2	17.3	17.5	14.1
Fe_2O_3 *	13.0	6.69	17.6	5.51	5.69	15.3
MgO	3.40	4.80	6.72	3.01	3.46	4.29
CaO	9.85	5.31	8.79	7.39	10.10	8.49
Na_2O	2.22	1.66	1.97	3.28	3.40	1.56
K_2O	0.23	0.12	0.24	0.25	0.05	0.23
TiO_2	0.73	1.03	1.32	1.11	0.65	2.13
P_2O_5	0.12	0.23	0.10	0.17	0.09	0.21
MnO	0.64	0.36	0.23	0.17	0.10	0.24
CO_2 **	0.25	2.64	0.25	0.29	1.79	1.01
S^2	0.1	<0.01	0.06	<0.01	0.01	0.02
L.O.I. ***	1.0	5.2	0.8	0.9	3.4	3.8
Total	97.99	100.90	100.37	99.99	100.74	99.65
S.G.	2.98	2.70	3.07	2.78	2.87	2.91
			C.I.P.W. Norms			
Ap	0.29	0.56	0.24	0.40	0.22	0.51
Il	1.45	2.05	2.56	2.13	1.27	4.27
Or	1.42	0.75	1.45	1.50	0.31	1.44
Ab	19.58	14.74	16.99	28.09	29.66	13.94
An	35.27	26.07	29.76	32.13	33.35	32.52
C	0.00	0.56	0.00	0.00	0.00	0.00
Mt	3.37	3.85	4.17	3.83	3.21	5.56
Hm	0.00	0.00	0.00	0.00	0.00	0.00
En	6.62	12.55	14.43	6.34	3.90	9.33
Fs	12.47	3.94	17.54	0.95	1.44	11.54
Q	6.97	34.94	1.18	21.59	12.42	12.13
Di	4.75	0.00	5.67	2.69	10.76	4.22
Fo	0.00	0.00	0.00	0.00	0.00	0.00
Fa	0.00	0.00	0.00	0.00	0.00	0.00
He	7.80	0.00	6.01	0.35	3.47	4.55
Ru	0.00	0.00	0.00	0.00	0.00	0.00

* Fe_2O_3 as total iron

** Included in L.O.I.

*** Loss on Ignition

Sample Number	78-11-237	78-11-258	78-11-277	78-11-357	78-11-257	78-11-259
Irvine & Baragar Rock Name	Thole Basalt	Thole Basalt	Thole Basalt	Thole Basalt High Al	Gabbro Thole	Mafic Dyke Basalt Feeder Thole
SiO_2	48.4	50.2	45.6	50.5	47.8	45.6
Al_2O_3	15.2	15.3	14.6	16.6	14.2	13.5
Fe_2O_3*	14.5	13.3	20.9	11.1	16.7	12.8
MgO	7.11	7.94	3.86	8.76	5.81	9.88
CaO	9.83	9.21	9.78	9.48	8.47	11.2
Na_2O	2.40	1.12	1.05	0.74	3.17	1.11
K_2O	0.07	0.90	0.19	0.09	0.22	1.31
TiO_2	1.32	0.78	2.08	0.52	1.41	0.79
P_2O_5	0.10	0.10	0.14	0.09	0.15	0.07
MnO	0.22	0.21	0.26	0.12	0.24	0.20
$CO_2$1**	0.36	0.19	0.48	0.42	0.89	1.03
S^2	0.02	0.18	0.02	>0.01	0.01	0.34
L.O.I.***	0.8	1.4	0.4	2.2	2.2	2.2
Total	99.95	100.46	98.86	100.20	100.37	98.66
S.G.	3.01	3.04	3.12	2.93	3.00	3.08
			C.I.P.W. Norms			
Ap	0.24	0.24	0.34	0.22	0.36	0.17
Il	2.56	1.51	4.08	1.02	2.77	1.57
Or	0.42	5.43	1.16	0.55	1.34	8.12
Ab	20.72	9.67	9.18	6.45	27.71	9.84
An	31.13	34.77	35.73	42.96	24.66	29.33
C	0.00	0.00	0.00	0.00	0.00	0.00
Mt	4.17	3.38	5.37	3.02	4.36	3.48
Hm	0.00	0.00	0.00	0.00	0.00	0.00
En	13.48	17.65	8.20	21.25	7.18	6.23
Fs	11.57	13.77	19.37	12.37	9.19	3.68
Q	0.00	4.38	5.09	8.21	0.00	0.00
Di	8.46	5.47	3.75	2.63	6.99	15.26
Fo	0.47	0.00	0.00	0.00	3.17	8.75
Fa	0.44	0.00	0.00	0.00	4.46	5.69
He	6.34	3.72	7.72	1.34	7.80	7.87
Ru	0.00	0.00	0.00	0.00	0.00	0.00

* Fe_2O_3 as total iron

** Included in L.O.I.

*** Loss on Ignition

Sample Number	78-11-260	78-11-38	78-11-39	78-11-60	78-11-216	78-11-222
Irvine & Baragar Rock Name	U/M[4] Amoco U/G	Calc-alk Andesite	Calc-alk Rhyolite	Calc-alk Rhyolite High Al	Calc-alk Dacite High Al	Calc-alk Dacite High Al
SiO_2	43.8	58.6	76.7	70.2	69.5	66.8
Al_2O_3	9.34	15.6	12.8	16.9	15.7	16.5
Fe_2O_3 *	11.9	11.3	1.28	0.70	2.83	4.80
MgO	21.6	3.68	1.18	0.35	0.72	1.94
CaO	8.02	2.88	1.25	1.27	3.70	1.40
Na_2O	0.00	4.46	0.00	4.23	3.62	4.02
K_2O	0.00	0.81	5.63	4.22	0.46	1.53
TiO_2	0.36	1.53	0.30	0.20	0.42	0.57
P_2O_5	0.11	0.37	0.08	0.07	0.07	0.16
MnO	0.16	0.14	0.06	0.01	0.05	0.05
CO_2**	0.33	0.14	0.28	0.23	0.70	1.60
S^2	0.41	0.01	0.01	0.01	0.02	0.05
L.O.I.***	4.9	1.0	1.6	0.5	3.0	3.0
Total	100.19	100.37	100.88	98.65	100.07	100.77
S.G.	2.99	2.80	2.65	2.62	2.70	2.67
			C.I.P.W. Norms			
Ap	0.27	0.87	0.19	0.17	0.17	0.38
Il	0.73	2.95	0.13	0.02	0.82	1.11
Or	0.06	4.86	33.54	25.43	2.81	9.28
Ab	0.09	38.29	0.09	36.46	31.58	34.88
An	26.95	12.04	5.72	5.95	18.46	6.05
C	0.00	3.08	4.64	3.29	2.77	6.22
Mt	2.86	4.46	0.00	0.00	1.63	3.08
Hm	0.00	0.00	1.29	0.71	0.85	0.00
En	25.94	9.30	2.96	0.89	1.85	4.96
Fs	7.11	9.03	0.00	0.00	0.00	2.00
Q	0.00	15.12	51.22	26.88	39.06	32.03
Di	9.33	0.00	0.00	0.00	0.00	0.00
Fo	18.77	0.00	0.00	0.00	0.00	0.00
Fa	5.67	0.00	0.00	0.00	0.00	0.00
He	2.23	0.00	0.00	0.00	0.00	0.00
Ru	0.00	0.00	0.23	0.19	0.00	0.00

* Fe_2O_3 as total iron

** Included in L.O.I.

*** Loss on Ignition

Sample Number	78-11-251	78-11-253	78-11-261	78-11-279
Irvine & Baragar Rock Name	Thole Dacite	Calc-alk Dacite High Al	Thole Andesite	Calc-alk Rhyolite
SiO_2	62.6	66.7	80.4	73.0
Al_2O_3	14.9	17.2	12.5	14.3
Fe_2O_3*	8.24	2.62	0.81	1.91
MgO	2.06	0.56	0.76	0.78
CaO	2.55	3.65	1.33	3.76
Na_2O	4.06	3.34	0.43	0.25
K_2O	1.30	1.08	2.58	2.87
TiO_2	1.29	0.36	0.09	0.65
P_2O_5	0.22	0.10	0.06	0.23
MnO	0.13	0.05	0.02	0.13
CO2**	0.32	2.00	0.21	0.41
S^2	0.01	>0.01	0.01	0.02
L.O.I***	2.4	2.4	1.5	2.0
Total	99.75	98.06	100.48	99.88
S.G.	2.74	2.67	2.71	2.74
		C.I.P.W Norms		
Ap	0.53	0.24	0.14	0.55
Il	2.53	0.72	0.04	0.28
Or	7.94	6.68	15.58	17.34
Ab	35.48	29.56	3.71	2.16
An	11.58	18.26	6.33	17.52
C	2.79	4.33	6.86	4.59
Mt	4.18	1.39	0.00	0.00
Hm	0.00	0.99	0.83	1.95
En	5.30	1.46	1.93	1.98
Fs	4.97	0.00	0.00	0.00
Q	24.69	36.37	64.50	53.11
Di	0.00	0.00	0.00	0.00
Fo	0.00	0.00	0.00	0.00
Fa	0.00	0.00	0.00	0.00
He	0.00	0.00	0.00	0.00
Ru	0.00	0.00	0.07	0.51

* Fe_2O_3 as total iron

** Included in L.O.I.

*** Loss of Ignition

TABLE 4: Location of Samples taken for Chemical Analyses

Field Number	Township/Area	Latitude	Longitude	Lab No.
78-11-19	Steel Tp.	49°00'30"	79°54'50"	78-3711
78-11-72	Kenning Tp.	49°16'50"	79°53'00"	78-3715
78-11-83	NE of Hopper Lk.	50°01'30"	79°49'00"	78-3716
78-11-133	Steele Tp.	49°01'20"	79°56'00"	78-3717
78-11-233	Hurtubise Tp.	49°23'35"	79°47'20"	78-3720
78-11-234	St. Laurent Tp.	49°24'45"	79°40'00"	78-3721
78-11-237	St. Laurent Tp.	49°20'40"	79°31'05"	78-3722
78-11-258	Amoco U/G	50°00'50"	79°42'25"	78-3726
78-11-277	N of Detour L.	49°57'10"	79°43'10"	78-3730
78-11-357	Abbotsford Tp.	49°04'10"	79°43'30"	78-3732
78-11-38	Abbotsford Tp.	49°08'00"	79°45'45"	78-3712
78-11-39	Abbotsford Tp.	49°07'55"	79°45'25"	78-3713
78-11-60	Kenning Tp.	49°12'02"	79°54'40"	78-3714
78-11-216	Bradette Tp.	49°27'30"	79°34'40"	78-3718
78-11-222	Bradette Tp.	49°31'50"	79°32'00"	78-3719
78-11-251	Noseworthy Tp.	49°29'13"	79°50'35"	78-3723
78-11-253	Noseworthy Tp.	49°28'41"	79°50'40"	78-3724
78-11-261	Amoco U/G	50°00'50"	79°42'25"	78-3729
78-11-279	N. of Detour L.	49°56'50"	79°43'05"	78-3731
78-11-257	Lower Detour L.	49°56'00"	79°37'30"	78-3725
78-11-259	Amoco U/G	50°00'50"	79°42'25"	78-3727
78-11-260	Amoco U/G	50°00'50"	79°42'25"	78-3728

traced from the Quebec border to Abbotsford Lake, 22.5 km to the northwest, where they are interpreted by the author to pinch out. Lumbers (1963) recognized massive, amygdaloidal, pillowed, gabbroic, and porphyritic flows. In addition the author examined tuff and lapilli to pyroclastic breccia interbedded with the flows southeast of Abbotsford Lake.

The amphibole-rich flows are fine to medium grained varying in colour from grey or pale green to dark greenish black. Epidote pods and veinlets are common in the finer grained flows. Pillowed flows are, for the most part, deformed, but just west of the Patten River Pluton Lumbers (1963) was able to ascertain south-facing stratigraphic tops. The porphyritic flows (Photo 1) found in southeastern Abbotsford Township consist of 50 percent white feldspar phenocrysts averaging 30 mm in length. The phenocrysts grade to the north, over a distance of 50 cm into massive fine-grained lava. Very fine grained, schistose,

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Photo 1–Mafic to intermediate feldspar porphyry flow found in the southeastern part of Abbotsford Township just north of the sedimentary-volcanic contact.

garnetiferous, porphyritic tuffs are found interbedded with the metavolcanics of the Adair Volcanics and may be mistaken for porphyritic flows. The garnets, occupying up to 15 percent of the rock, are subhedral and pale pink to white in colour. The matrix is a fine-grained dark green, soft, schistose mafic tuff.

Mafic to intermediate pyroclastic rocks have been recognized 3.5 km southeast of Abbotsford Lake. Fine-grained, dark greyish green, dense, garnetiferous tuff is interbedded with a lapilli-breccia. The lapilli-breccia contains light grey, tuffaceous clasts, 40 mm in maximum dimension set in a dark green matrix. The clasts are subrounded and elongated parallel to foliation.

Hornblende, tremolite, actinolite, sericitized feldspar, garnet, and epidote are common rock-forming minerals with biotite, chlorite, and opaques as accessories. Relict bedding is visible in thin sections of the fine-grained dense tuffs. The rocks are highly metamorphosed and garnet is commonly visible in the outcrops. An analysis of a rock sample from near the contact with the Scapa Metasediments classified the mafic to intermediate flow as a high-magnesium tholeiitic basalt.

Mafic Metavolcanics North of the Mistawak Batholith

The mafic to intermediate metavolcanic rocks found north of the Mistawak Batholith and interpreted to be around the Bateman Lake Pluton are exposed

in northeastern Kenning Township and southern Hurtubise and St. Laurent Townships. Lithologic rock types recognized are massive and pillowed flows with autoclastic breccia, tuff, and pyroclastic breccia. Along the Case and Kabika Rivers in Kenning Township, south of the Hurtubise Stock on the East Kabika River and on the Burntbush River the mafic to intermediate metavolcanics are chloritic and have been carbonatized. In central Hurbubise Township and northwest and northeast St. Laurent Township the mafic to intermediate rocks have been epidotized. In southern Hurtubise and St. Laurent Townships the metavolcanics are all amphibolitized.

The chloritic, carbonatized mafic to intermediate metavolcanics are soft, well foliated, weather dark cream green, and are pitted on the weathered surface. Fresh surfaces are medium to dark green. The epidotized flows are very fine grained and have a cream weathered surface and a pale green to greyish green fresh surface. The amphibolitic metavolcanics are fine grained, crystalline, weather dark brownish buff, and are dark green on fresh surfaces. Epidote clasts and stringers are common as are rust stained fractures and joints.

The pillows found in the epidotized rocks are generally little deformed, are up to 1 m in maximum dimension and exhibit well developed selvages up to 5 cm thick, and contain amygdules filled with carbonate and quartz. Pillows in the amphibolites are usually somewhat deformed but generally good enough to determine tops. Associated with those pillows are zones of autoclastic breccia. The breccias are composed of monolithologic, 10 to 20 mm subangular, fragments surrounding broken pillows which have brecciated cores cemented by carbonate.

Tuff and pyroclastic breccia are rare and were noted on the Kabika and East Kabika Rivers. They are thick bedded, varying from fine- to medium-grained lithic to crystal lithic tuff associated with pods of iron-rich metasediments. The pyroclastic breccia contains stretched, light green porphyritic blocks in a dark green extensively foliated chloritic matrix.

The carbonatized, chloritic rocks contain chlorite, feldspar, and epidote with associated sericite, carbonate, quartz, and hornblende. Secondary, quartz eyes were observed in hand sample and were noted to be strained in thin section. The epidotized flows contain feldspar phenocrysts (An_{26-33}) in a very fine grained, highly altered groundmass containing granular clouds of epidote. Chlorite and quartz occur as vesicle fillings. The amphibolites are fine grained, crystalline, and contain hornblende, chlorite, and feldspar with minor epidote, sericite, and opaques.

Mafic Metavolcanics North of Detour Lake

The mafic to intermediate metavolcanics found north of 49°45′ North Latitude, except for two small bands around Vandette Lake, are interpreted to be from the same stratigraphic unit. The two mafic to intermediate horizons through Atkinson Lake and Cuthbert Lake have no outcrop associated with them and were interpreted from diamond drill hole data[1] and aeromagnetic

[1]Unless otherwise stated all drill hole data are from the Assessment Files Research Office, Ontario Geological Survey, Toronto

maps (ODM-GSC 1963a,b,c,d,e). Outcrop is found along the north and south limbs of the northwest-trending anticline that is found north of Lower Detour Lake. Except for the outcrops near the quartz monzonite batholith, which are medium-grained amphibolites, the rocks are fine grained and have well preserved primary textures. The following lithologic types were recognized; flows, pillow flows with autoclastic breccia, tuff, lapilli-breccia to pyroclastic breccia, and porphyritic flows.

The flows weather a dark olive green and have a dark green fresh surface. Epidote clots and stringers are common as well as garnets which are found in pillow selvages and foliated tuffs. One kilometre northeast of the Amoco Site (Property 4[1]) the outcrops containing flow material also have associated with them minor medium-grained, crystalline gabbro. Pillowed flows with garnetiferous selvages are common throughout. Several top determinations were obtained from these and other pillows. Autoclastic breccia associated with the pillow lavas is found west of Lower Detour Lake. This breccia is monolithologic containing unsorted subangular to angular fragments, ranging from less than 10 mm to 10 cm in size. North of Detour Lake interbedded, dark green, fine-grained, foliated garnetiferous tuff is found interbedded with decimetre thick, unsorted, beds of tuff-breccia. The tuff-breccia is heterolithologic with intermediate and mafic clasts ranging in size from less than 2 mm to 60 to 70 mm. The clasts of intermediate composition are elongated from 3 to 4:1 and the mafic clasts are elongated 6:1. The clasts, in general, are more felsic than the tuffaceous matrix. Minor porphyritic flows with less than 10 percent feldspar phenocrysts 12 mm in size are found interbedded with massive equigranular flows.

The information obtained from diamond drill logs and observation of outcrops indicates that felsic to intermediate tuffs, sediments, and gabbros are interbedded with the flows.

The flows are fine grained, equigranular, and contain minor mineral segregation bands. Hornblende and feldspar are the common rock-forming minerals with minor epidote, sphene, and opaques. Patchy sericite alteration was noted. The tuffs contain hornblende, chlorite, garnet, biotite, and carbonate. Feldspar is lacking but this may be due to the metamorphic reaction leading to the formation of garnet.

Chemically these rocks are high-iron tholeiitic basalts.

FELSIC TO INTERMEDIATE METAVOLCANICS

The felsic to intermediate metavolcanics have exposures in Adair, Abbotsford, and Kenning Townships, Bradette and Noseworthy Townships, and in isolated outcrops in the northern part of the map-area. Using diamond drill hole logs and geophysics they are interpreted to be extensive within the northern supracrustal belt.

[1]Number in parenthesis after property name refers to deposit number on map in back pocket.

Common mineral assemblages for the intermediate metavolcanic rocks are as follows:

sericite + feldspar + quartz + carbonate + chlorite + epidote + biotite + garnet;
chlorite + hornblende + biotite + feldspar + quartz + garnet;
hornblende + feldspar + quartz + sericite + carbonate + biotite.

The common mineral assemblages for the felsic metavolcanic rocks are as follows:

feldspar + muscovite + sericite + quartz;
sericite + feldspar + quartz;
sericite + feldspar + quartz + carbonate + epidote.

The metamorphic grade is predominantly almandine-amphibolite facies. Tuff is the most extensive lithologic type found within the felsic to intermediate metavolcanics with lapilli-tuff, pyroclastic breccia, tuff-breccia, and flows occurring in lesser amounts. The classification scheme used in describing the pyroclastic rocks is from R.V. Fisher (1966, p.292).

Adair Metavolcanics

The felsic to intermediate metavolcanics that occur within Lumber's (1963) Adair Volcanics are interdigitated with the mafic to intermediate metavolcanics. The felsic to intermediate component of the Adair Volcanics can be traced from the Quebec border to the southeast corner of Kenning Township, a distance of 33 km. In northwestern Abbotsford Township and southeastern Kenning Township, the mafic to intermediate component has disappeared and the felsic to intermediate metavolcanics are interdigitated with the clastic metasediments. Lumbers (1963) described tuffs, porphyritic flows, and "agglomerates". The author has seen in addition to the tuffs and flows some coarser grained lapilli-tuff and tuff-breccia. All the rocks are garnetiferous. The author did not examine the outcrops east of the Mace Bay road and the reader is referred to Lumbers (1963, p.11, 12) for detailed descriptions.

The metavolcanics of more intermediate composition weather a light grey with a light green to grey fresh surface. The more felsic the composition the lighter the weathered colour becomes until an outcrop appears white. The felsic metavolcanics have a hackly weathered surface and generally have a conchoidal fracture.

The tuffs are well sorted, fine grained, recrystallized, and generally thin bedded. The felsic tuffs locally have beds less than 1 mm thick. A eutaxitic rhyolite tuff (Photo 2) is found east-southeast of Abbotsford Lake. It is 7 m thick with an associated pyritiferous horizon. Stretched cherty quartz pods, approximately 1 mm by 15 mm imparts the eutaxitic texture. Lapilli-tuff, up to 7 m thick, occurs interbedded with the tuff. Stretched clast sizes range from 3 mm to 15 mm in length. The fragments are generally more felsic in appearance than the matrix. Isolated occurrences of coarser grained pyroclastics were found southeast of Abbotsford Lake and Lumbers (1963) reported finding "agglomerate" south of Joe Lake. Coarse grained pyroclastics are found around the Normetal Mine in Desmeloizes Township in Quebec (MNR Special Paper No. 2,

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Photo 2–White, eutaxitic rhyolite tuff, tectonically interfingered with the darker intermediate tuff. Found east-southeast of Abbotsford Lake.

1967). There appears to be a westward fining of the pyroclastics and as such the majority of the felsic to intermediate rocks are distal facies.

Flows are few and where they do occur they are coarse grained, recrystallized, and resemble leucocratic amphibolites.

In thin section the bedding is generally obscure. The primary features are vague and recrystallization is common. Sericite and muscovite are the common mica minerals. A potassium feldspar-rich recrystallized tuff is found in southeast Kenning Township.

Felsic Metavolcanics in the Burntbush River Area

The felsic to intermediate metavolcanics that are interpreted to be in Bradette, St. Laurent, Hurtubise, and Noseworthy Townships are presumed to overlie the mafic to intermediate metavolcanics and to nose out to the west. Interbedded with them are mafic to intermediate metavolcanics, clastic metasediments, and graphitic horizons. This unit only appears in outcrop in southern Bradette and western Noseworthy Townships and along the Turcotte River in northern Bradette Township. Diamond drill logs and ODM-GSC aeromagnetic maps (ODM-GSC 1963a,b,c,d, and e) were used to interpret the extent of the unit.

Fine-grained to cherty, aphanitic, well sorted, felsic tuffs are the predominant rock-types. They weather a pale buff; outcrops have a hackly appearance and quartz eyes are common. The fresh surface is light grey and has a conchoidal fracture. Bedding is difficult to distinguish and the outcrops are commonly brecciated. A horizon of coarse-grained intermediate pyroclastic rocks is found along the Burntbush River. This horizon has been determined from data from diamond drill holes on either side of the river. The pyroclastic breccia is intermediate in composition and consists of matrix-supported intermediate to felsic blocks in a tuff matrix. The clasts, consisting of flow and tuff material, are generally greater than 10 cm in size but vary along the Burntbush River to lapilli-size fragments. The more mafic the clasts are in composition, the smaller are their average size.

Fine-grained, unsorted, well foliated, chloritized intermediate tuffs are found along the Burntbush River in Noseworthy Township. They have a dark grey weathered surface and a greenish grey fresh surface. Flows are rare, however a porphyritic flow was seen along the Burntbush River near its mouth. It is pale green to dark green, with medium- to coarse-grained, euhedral feldspars and smaller quartz crystals as its phyric phase in a very fine grained matrix.

The rocks, when observed in thin section, are commonly seen to be deformed sericite schists with minor chlorite and carbonate. They have a cryptocrystalline groundmass, which forms 20 to 60 percent of the rock, consisting of sericite, carbonate, chlorite, and epidote enclosing coarser grained feldspar and quartz grains. Recrystallization has almost completely destroyed all clastic textures.

Felsic Metavolcanics in the Lower Detour Lake Area

The felsic to intermediate units in the northern supracrustal belt are not exposed in outcrop and have been delineated using diamond drill hole logs and ODM-GSC aeromagnetic maps (ODM-GSC 1963a,b,c,d, and e). The oldest interpreted unit is intermediate tuff, interbedded with mafic flows and graphitic sediments, and is found at the core of the anticline north of Lower Detour Lake. Overlying the mafic to intermediate metavolcanic unit is the younger felsic to intermediate unit around Vandette and Dobson Lakes. This unit consists of tuffs interbedded with mafic flows, metasediments, and graphitic tuffs. Minor gabbro and ultramafic bodies were also encountered during diamond drilling.

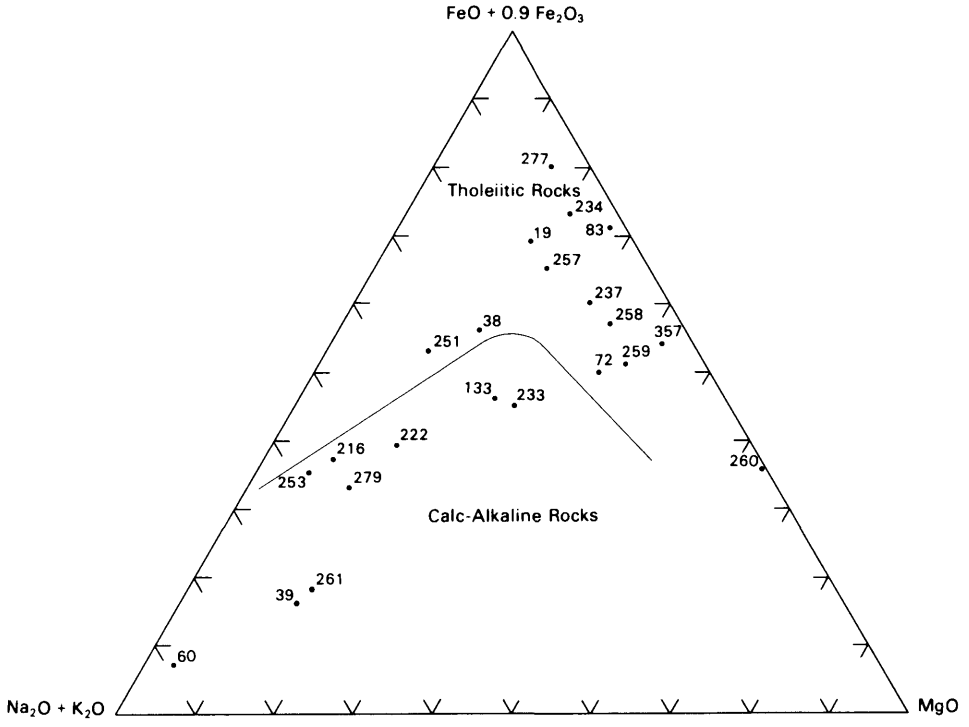

Figure 2–AFM plot after Irvine and Baragar (1971).

A single outcrop of bedded, fine-grained, well sorted felsic to intermediate tuff was seen north of Detour Lake. A cherty tuff was found within the ore zone at the Amoco Canada Petroleum Company Limited's (4) gold prospect and a thin intermediate crystal tuff is interbedded with the mafic flows on the surface.

Chemically all the felsic to intermediate metavolcanics are calc-alkaline dacites and rhyolites with minor tholeiitic dacite (Figures 2 and 3, Table 3).

Metasediments

CLASTIC METASEDIMENTS

Clastic metasediments occur at three stratigraphic intervals within the map-area. The metasediments, called the Steele Metasediments by Lumbers (1962), overlie the Steele Volcanics in the southwest corner of the map-area.

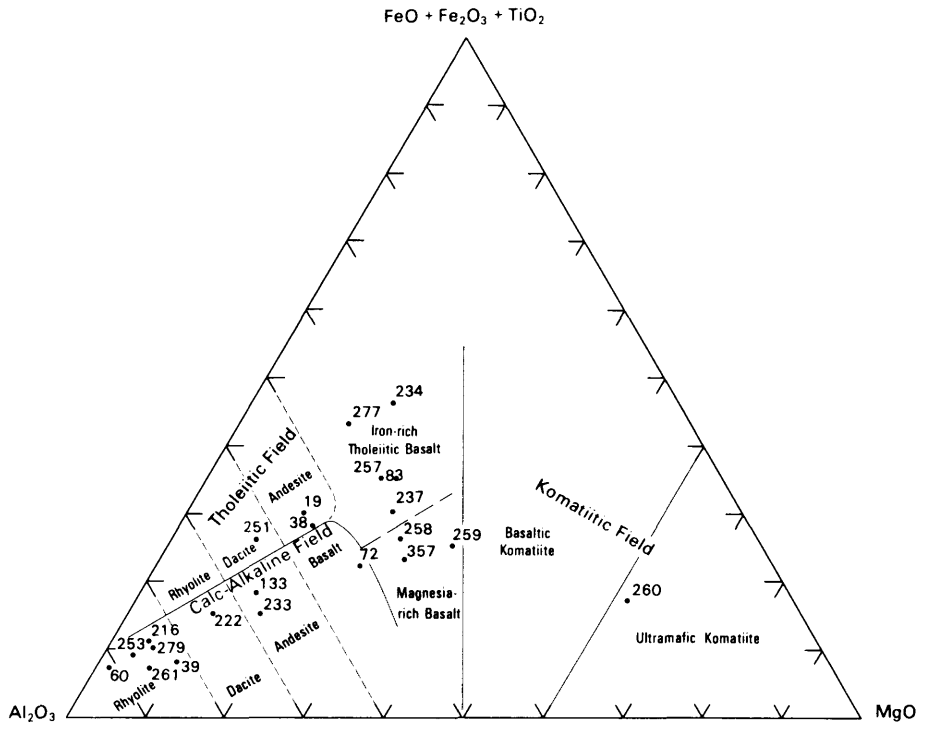

Figure 3–Jensen (1976) cation plot for subalkalic volcanic rocks, including komatiite.

The Scapa Metasediments (Lumbers 1962; 1963) lie between the Adair Volcanics and the Steele Volcanics in the south and are interpreted to be continuous around the western end of the folded nose of the southern belt of supracrustal rocks, and are found in northern Hoblitzel, Noseworthy, and Bradette Townships. In the northern supracrustal belt, clastic metasediments are found underlying and overlying the mafic to intermediate metavolcanics around Detour Lake. They are also interbedded with the mafic to intermediate and felsic to intermediate rocks as noted in diamond drill logs.

Common mineral assemblages for the clastic metasediments are:

quartz + feldspar + biotite + muscovite + garnet;
quartz + feldspar + biotite + staurolite + sillimanite;
quartz + biotite + chlorite + garnet + muscovite + hornblende.

The metamorphic grade is highest next to the intermediate to felsic intrusive rocks. In the less metamorphosed sediments primary textures, such as graded bedding, crossbedding and load casts, are well preserved. The predominant lithologic types are turbidite wacke with minor calc-silicate beds, schist, arenite, and arkose. Fine-grained and graphitic horizons have very few outcrops, but are described in diamond drill logs.

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Photo 3–Load casts with a flame-like shape in the wackes southeast of the Scapa Stock. Note foliation is oblique to the bedding.

The turbidite wackes that occur in the Steele Metasediments and Scapa Metasediments are similar in appearance. They have a brownish grey to light grey weathered surface and a grey fresh surface. Wacke with graded beds contains a narrow zone of phyllite at the top of individual beds which range in thickness from 6 mm to 8 to 12 cm. A few beds are 30 to 60 cm thick. Massive nonbedded wacke is less common than the graded variety. The divisions within the Bouma Cycle (Walker 1976) that were seen within the map-area are, in decreasing order, A, AE, & ACE. Sedimentary structures such as crossbedding and load casts (Photo 3) are not common. Photo 3 is of a flame-like load cast forcing its way through an overlying pelitic bed. The high relief, boudined bed is a calc-silicate bed.

Between the Steele Volcanics and the Case Batholith, the sedimentary rocks have been metamorphosed to garnet and staurolite schists. All sedimentary structures are gone and the rocks are garnetiferous chlorite-biotite-feldspar-quartz schist; biotite-muscovite-feldspar-quartz schist, and quartz-plagioclase-garnet-biotite-staurolite schist. Porphroblastic biotite, up to 6 mm in size, is found within the less metamorphosed wackes. These wackes are composed of biotite, feldspar, quartz, sericite, and accessory amounts of chlorite, rock fragments, epidote, and sphene.

A narrow contact aureole, 91 m to 200 m wide, occurs within the metasediments bordering the Scapa Stock in northwestern Scapa Township. Two zones can be distinguished within the aureole: an outer garnet zone which grades away from the stock over a distance of 200 m; and an inner zone of hornfels about 90 m wide which grades into the granite. For further detail see Lumbers (1962, p.17).

Within the wackes, thin calc-silicate beds occur and are described by Lumbers (1962, p.16) as follows:

> Calc-silicate rocks occur as narrow layers intercalated with the metamorphosed greywackes. The layers range in thickness from less than 1 inch to 6 inches and are traceable for considerable distances in the outcrop. A few layers pinch and swell along strike, but uniformity of thickness is the rule.
>
> The calc-silicate layers are similar to those described by Pettijohn (1940, p.1846-47)[1] from the Thunder Lake area of Ontario and called by him hornblende granulite. In hand specimen the rock resembles diorite with numerous needles of greenish amphibole scattered in a fine-grained, light-coloured matrix. The rock weathers a buff colour but is light grey on a fresh surface. In thin-section the layers are composed of a granoblastic matrix of quartz, calcic plagioclase, and epidote in which there are randomly oriented rosettes and sheaves of blue-green amphibole. The plagioclase is commonly clouded by sericite, making its determination difficult, but it appears to be near andesine in composition. Sphene, pyrrhotite, and carbonate are common accessory minerals. Some specimens contain small amounts of garnet.

Between the Steele Volcanics and Case Lake minor interbeds of arenite and grit occur within the wackes. The arenites are thin beds which are lighter in colour and cleaner in composition than the wackes. The grit is composed of lithic fragments between 2-4 mm in size. In Hoblitzel Township along the Mikwam River, arkose has been mapped during Operation Kapuskasing (Bennett *et al.* 1967) and when they are similar to those seen by Lumbers (1962), they contain predominantly quartz and feldspar, in equal amounts.

Fine-grained metasediments were seen along the Burntbush River in Noseworthy and Hoblitzel Townships and are described in many diamond drill logs. Where seen by the author they were silt size, well foliated, and occurred in 1 to 2 cm thrick crossbeds. Graphitic metasediments and tuff were not seen in outcrop but were noted in diamond drill logs.

Within the Case Batholith xenoliths of granoblastic metasediments are common. In the northern part of the map area a large "stoped" block of metasediments is outlined. These outcrops and the metasedimentary outcrops north of Detour Lake were not visited by the author and as such their nature is unknown. From diamond drill hole information most of the metasediments in the north are wacke or schist.

[1]Pettijohn, F.J.
1940: Archean Metaconcretions of Thunder Lake, Ontaro; Geol. Soc. America Bull., Vol. 51, No. 12, pt.1.

The chemical metasediments, consisting of ironstone[1] and chert are in outcrop in the southeastern part of Kenning Township and along the Kabika River. Aeromagnetic anomalies (ODM-GSC 1963a,b,c,d, and e) interpreted to be caused by ironstone-rich metasediments are found in the Adair Volcanics in Abbotsford Township; the clastic metasediments and mafic to intermediate metavolcanics in Kenning Township; the mafic to intermediate metavolcanics in Hurtubise and St. Laurent Townships; the metasediments and felsic to intermediate metavolcanics in Bradette Township; and the metavolcanics just west of Vandette Lake.

The ironstones, argillites, and cherts are interbedded in 2 to 10 mm beds which occur in ironstone-rich units up to 60 cm thick. Interbedded with those ironstone rich units are interbedded units of thinly garnetiferous wacke, very fine grained metasediments, chert, and minor ironstone. Non-iron-rich wacke, chert, or argillite beds can be up to 15 cm thick. The richest part of the iron-rich metasediments occurs at the nose of the fold (in southeastern Kenning Township) and is 727 m long and 61 m wide. The rest of the outcrops contain small lenticular ironstone-rich pods. Bedding is contorted and minor faulting common.

The clastic metasediments associated with the chemical metasediments are garnetiferous and recrystallized. On one outcrop there is a thick horizon of cherty tuff which is separating two iron-rich pods.

Metamorphosed Mafic and Ultramafic Intrusive Rocks

The metamorphosed mafic and ultramafic intrusive rocks consist of gabbros, amphibolites, feeder dikes and sills, and ultramafic rocks. The ultramafics are not exposed on the surface. Underground at the Amoco Canada Petroleum Company Limited's (4) gold prospect an amphibole-chlorite schist with komatiitic affinities is associated with the orebody. The gabbros occur as small concordant and discordant bodies in the mafic to intermediate metavolcanics in the northern supracrustal belt. Possible gabbroic intrusive bodies are hypothesized for the Steele Volcanics but the extent of the metamorphism and recrystallization precludes easy recognition of such bodies. The amphibolites are exposed in the metasediments of Scapa Township and south-southwest of Detour Lake. The mafic feeder dikes are found underground at the Amoco prospect, in the felsic to intermediate metavolcanics southeast of Abbotsford Lake, and in the Scapa Metasediments.

[1]The term ironstone is used here as defined in the unpublished classification manual of the Ontario Geological Survey, issued 1978: a chemical sedimentary rock that contains 33 percent or more of the common iron minerals by volume. This definition excludes other chemically precipitated sediments such as chert, and clastic sedimentary material, that are commonly interlayered with ironstone.')

The common mineral assemblages for the rocks are:

Metagabbro—chlorite + feldspar + hornblende + biotite + epidote + carbonate;

Ultramafic rocks—tremolite + chlorite + opaques;

Feeder dike—chlorite + feldspar + carbonate + muscovite + epidote;

Amphibolite—hornblende + feldspar + epidote + quartz + biotite + carbonate.

The gabbro bodies, where exposed, are generally small, discrete entities but small dikelets are associated with the metavolcanics west of Sunday Lake. They are medium grained, equigranular, crystalline, massive to foliated with a dark green weathered surface and a dark grey green fresh surface. Epidote veins are common as well as quartz veins. The porphyritic body west of Sunday Lake has 1 to 20 percent phenocrysts that vary in size from 4 to 10 mm. The gabbro found along the shore of Lower Detour Lake is fine to medium grained with coarse-grained parts. The foliated parts are chloritic whereas the massive parts contain amphiboles. The outcrop on the south shore of Lower Detour Lake contains secondary quartz eyes banded into quartz-rich (15 to 25 percent) and quartz-poor (less than 10 percent) zones.

The amphibolites found south-southwest of Detour Lake are coarse grained, massive, dark green on weathered and dark green-black on fresh surfaces. Recrystallization is such that feldspars were starting to form discrete bands. The amphibolites in Scapa Township were seen and described by Lumbers (1962, p.25) as follows:

> Amphibolite, derived by metamorphism from gabbro and diabase, is the most abundant rock type of the basic intrusions. The amphibolites are composed of 40-65 percent blue-green hornblende, set in a fine grained groundmass of epidote, quartz, and feldspar. Relict laths of plagioclase up to 1 millimetre long are present, and where these are abundant the rock shows ophitic texture. Biotite and carbonate are common, and altered magnetite-ilmenite is an accessory mineral. Tourmaline is rare.
>
> There is evidence of multiple intrusions of the sill- or dike-like bodies at many localities. The best example of multiple intrusion is in a well-exposed outcrop at the east boundary of Scapa township. Here, a metagabbroic sill, about 10 feet wide, showing chilled contacts against the metasediments, is intruded by irregular dikes of a second metagabbroic rock, ranging from ½ inch to 4 feet wide, which display chilled margins against the sill. Disseminated pyrite, pyrrhotite, and chalcopyrite are found at the contact between the two rocks.

The mafic feeder dikes, where recognized, are fine grained, dense, dark grey on weathered surface and dark green on fresh surface. They have chilled margins and irregular contacts with the host rock.

Felsic to Intermediate Intrusive Rocks

The metavolcanic-metasedimentary sequence has been intruded by felsic to intermediate bodies that compose about 50 percent of the map-area. In the southern half of the area these intrusive bodies have been called: the Case Batholith; the Mistawak Batholith; the Patten River Pluton; the Bateman Lake Pluton; the Hurtubise Stock and the Scapa Stock. The major intrusive bodies or body separating the northern and southern supracrustals have not been named. The intrusive rocks have been classified according to Ayres (1972).

CASE BATHOLITH

The Case Batholith is in the southwest part of the map-area and is bounded by the Scapa Metasediments, Adair and Steele Volcanics, and is open to the west. Lumbers (1962, p.29-30) has given a detailed description of that part of the intrusive in Steele Township and his description is valid for the exposures seen by the author.

Within Steele Township the rocks comprising the batholith range in composition from leucogranodiorite near the contact with the Scapa Metasediments, to leucocratic quartz monzonite farther away from the Scapa Metasediments. The rocks are pink in colour, massive and coarse-grained. Numerous pegmatite dikes and irregular pegmatitic patches occur in the granodiorites and quartz monzonites.

A pegmatite dike occurring in quartz monzonite, in lot 5, concession V, Steele township, contains spodumene, columbite-tantalite, and molybdenite. Pegmatites occurring in the metasediments and metavolcanics near the contact with the Case batholith, in lots 8-12, concession IV, Steele township commonly contain scattered plates of molybdenite, but no spodumene or columbite-tantalite was found in them.

Albitized quartz-feldspar porphyry dikes and feldspar porphyry dikes are abundant in the Scapa Metasediments both in Steele and Scapa townships; a few also occur in the Steele Volcanics. The porphyry dikes strike parallel to the regional structure; they differ from the porphyry dikes associated with the Sargeant batholith in containing abundant potash feldspar and rare accessory rutile.

The composition of the granodiorite is about 50-55 percent plagioclase (An_{28}), 15-25 percent quartz, 7-15 percent potash feldspar, and accessory epidote, muscovite, biotite, chlorite, sphene, zircon, apatite, tourmaline, and rare opaque minerals. The percentages of potash feldspar were estimated from stained specimens.

Some of the granodiorites are porphyritic, containing large phenocrysts of plagioclase.

The composition of the quartz monzonite is about 25-35 percent plagioclase (An_{25-28}), 30-40 percent potash feldspar, 25-35 percent quartz, and accessory muscovite, biotite, chlorite, apatite, zircon, and opaque minerals. As in the case of granodiorite, the percentage of potash feldspar was estimated from stained specimens.

Homogeneous hybrid rocks occur in places within the batholith, particularly at or near the contact with the Scapa Metasediments. All the hybrid rocks are porphyroblastic, and they contain no potash feldspar. They are essentially quartz-plagioclase rocks, but all have minor blue-green hornblende and greenish brown biotite.

The composition of the hybrid rocks is about 55-70 percent plagioclase (An_{28-32}), 15-20 percent quartz, 10-12 percent biotite, 2-8 percent hornblende, and accessory chlorite, sphene, apatite, and epidote (pistacite with cores of allanite).

Inclusions of partly assimilated metasediments are commonly associated with the hybrid rocks, and it would appear that the hybrid rocks owe their origin to the mixing of sedimentary material with the "magma" of the batholith.

No detailed study was made of the pegmatites, although special attention was given to those containing minerals of economic significance. The pegmatites vary widely in size and shape; some are tabular or dike-like in form, others are irregular. The pegmatite dikes occurring within the batholith range in width from less than 1 inch to about 100 feet. Many of the dikes have sharp contacts suggesting intrusion into the host rocks (granodiorite and quartz monzonite). In thin section, the rock adjacent to the dikes is invariably fractured and embayed by aplitic material, which commonly forms a border phase of the pegmatites.

The origin of the irregular pegmatitic bodies is unknown. Both the irregular masses and dikes of pegmatite are more or less evenly distributed throughout the Case batholith in Steele township. The largest dikes were found near the contact with the Scapa Metasediments.

The contact between the pegmatite and aplite is gradational. The border phase is commonly scalloped and contains trains of garnet. Hexagonal quartz crystals and plates of muscovite up to 2 inches in size are conspicuous constituents of the pegmatites in hand specimen.

The spodumene-bearing pegmatite dike occurring in lot 5, concession V, Steele township, is complex and zoned. This is the only complex pegmatite noted within the batholith. The pegmatite

displays a narrow aplitic border phase in places and contains numerous quartz-rich patches, which appear to form the core of the pegmatite. Spodumene crystals, up to 3 feet long and 6 inches across, are most abundant in the quartz-rich patches. Columbite-tantalite, muscovite, and tourmaline are found with the spodumene. Molybdenite is rare.

Pegmatites occurring in the Steele Volcanics and Steele Metasediments in the vicinity of lots 7-11, concession IV, Steele township, are composed largely of coarse quartz with only minor amounts of feldspar and mica. Molybdenite is sparsely distributed in these pegmatites, commonly in association with aplitic and feldspathic portions of the pegmatite.

MISTAWAK BATHOLITH

The Mistawak Batholith is bounded by the metasediments - metavolcanics; in Kenning Township on the west, in Hurtubise and St. Laurent Townships on the north, in Adair and Abbotsford Townships on the south, and is open to the east. Lumbers (1963, p.20-22) has given a detailed description of the southern part of the batholith which coincides with what the author saw in the northern and western parts.

Leucocratic quartz monzonite and granodiorite predominate in the batholith as exposed in the map-area. Outcrops of quartz monzonite are pink to greyish-pink on a fresh surface, and light pink on a weathered surface. Biotite and epidote are the main mafic minerals, although amphibole is abundant in quartz monzonite exposed on the north shore of Joe Lake. The granodiorite is grey on a fresh surface, and grey with a slight green or pink tint on a weathered surface. Biotite and amphibole are common mafic constituents. Hematitized quartz is common in both quartz monzonite and granodiorite; both lithological types are medium- to almost coarse-grained, even-grained to porphyritic, and massive to well-foliated. Elongate, dark green, mafic-rich inclusions, commonly less than 2 inches long, are aligned parallel to the foliation in many granodiorites but are rare in quartz monzonites. Dikes and irregular masses of both lithological types cut one another in most outcrops, but the relationship of the quartz monzonite to the granodiorite is unknown.

Table I [Table 5, this report] shows modal analyses of nine typical quartz monzonites and two granodiorites. Plagioclase ranges in composition from about An_{23} in quartz monzonite to An_{28} in granodiorite. The plagioclase is commonly zoned, twinned, and moderately to highly altered to sericite, zoisite, and muscovite. Potash feldspar is fresh to slightly altered; it displays scotch-plaid twinning, and some is perthitic. A few medium-grained, subhedral potash feldspar grains, containing euhedral plagioclase inclusions, appear in quartz monzonite. Most of the potash feldspar forms fine-grained anhedral patches, interstitial to plagioclase, and myrmekitic intergrowths of quartz and feldspar are common at the junction of potash feldspar and plagioclase grains. Albite has partly replaced potash feldspar in many of the rocks examined.

Quartz is commonly strained and in some specimens fractured. Biotite has a greenish pleochroism and is partly altered to chlorite. The epidote present in the quartz monzonite and granodiorite is pistacite, rarely with a core of allanite, which generally is present in clusters with biotite. Accessory minerals are zircon, apatite, sphene, amphibole, and pyrite.

Granite pegmatite, aplite, felsite, granitic gneiss, and minor porphyry dikes constitute the remainder of the rocks associated with the batholith. Pegmatite and aplite are found as dikes, commonly less than 6 inches wide, in most outcrops of quartz monzonite and granodiorite. A few small magnetite crystals were found in pegmatite near the southwestern edge of Adair Hill.

Fine-grained, buff to pink coloured felsite, as dikes and irregular patches, was mapped in the vicinity of Joe Lake. The rocks are associated with granitic gneiss, and they cut the Adair Volcanic Rocks exposed on the south shore of Joe Lake. At this same locality, narrow feldspar porphyry and quartz-feldspar porphyry dikes also cut the Adair Volcanic Rocks. The porphyries are rocks weathering pink to white, with prominent feldspar and glassy quartz in a fine grained groundmass. Some porphyries contain minor disseminated pyrite.

Granitic gneiss is best exposed on the northeast shore of Joe Lake. The gneisses are grey, fine- to medium-grained rocks, consisting of layers rich in quartz, plagioclase, and potash feldspar, which alternate with layers rich in biotite, pistacite, and minor pyrite. The thickness of the layers ranges

TABLE 5: MODAL ANALYSES OF ROCKS OF THE MISTAWAK BATHOLITH[1]

(ac. = accessory mineral)

Specimen No.	Locality	Quartz	Plagioclase	Potash Feldspar	Hornblende	Biotite	Epidote	Accessories
L-204	North shore, Joe Lake.	26.6	36.5	23.1	10.5	ac.	2.6	0.7
L-219	1.5 miles east of mileage 20, "Mace Bay" road.	23.9	41.0	27.2	ac.	6.2	1.3	0.4
L-220	1.5 miles east of mileage 20, "Mace Bay" road.	23.0	46.0	27.4	ac.	1.5	1.1	1.0
L-222	Adair tower road, 0.9 miles east of "Mace Bay" road.	25.3	42.9	23.0	ac.	4.3	2.8	1.7
L-223	Adair tower road, 0.9 miles east of "Mace Bay" road.	25.3	41.5	28.4	ac.	3.5	0.6	0.7
L-224	Adair tower road, 2.5 miles east of "Mace Bay" road.	27.3	40.2	22.4	ac.	6.7	2.3	1.1
L-227	0.25 miles east of Adair Creek.	30.7	38.3	27.1	ac.	2.3	0.4	1.2
L-230	Road, 0.25 miles northeast of ranger's cabin, Adair Hill.	22.9	41.3	29.2	ac.	5.0	0.3	1.3
D-53	1 mile west of gravel pit, end of Adair tower road.	22.9	41.7	26.3	ac.	6.0	1.1	2.0
		GRANODIORITE						
L-221	Adair tower road, 0.9 miles east of "Mace Bay" road	28.6	51.1	6.1	5.5	6.1	1.7	0.9
L-229	0.75 miles north of ranger's cabin, Adair Hill.	29.3	51.5	8.2	ac.	9.2	1.0	0.8

[1] Lumbers (1963, Table I, p.21)

between a few millimetres and ¼ inch; in many places they are lens-shaped and discontinuous. In places the gneisses contain porphyroblasts of plagioclase up to 4 millimetres wide. Granitic gneiss, consisting of mixed granodiorite, quartz monzonite, and mafic-rich material, is found at the Forestry cabin near the foot of Adair Hill, and about 1 mile west of the cabin, on the Adair tower road.

PATTEN RIVER PLUTON

The Patten River Pluton in southeast Adair Township and northeast Hepburn Township was not visited by this field party but has been described by Lumbers (1963, p.22-24).

Covering an area of about 21 square miles, the Patten River Pluton is best exposed in Perron township in the province of Quebec. A western lobe of the pluton, comprising about 7 square miles, extends across the Interprovincial Boundary into the northeast corner of Hepburn and the southeast corner of Adair townships. The part of the pluton in Perron township has been described by Mawdsley (1930, p.47c)[1] and remapped by Flaherty (1939)[2].

Within the map-area, the pluton is poorly exposed, and except for its north contact, the boundary of the mass could not be precisely located. Most outcrops consist of a massive medium- to coarse-grained leucogranodiorite, weathering pinkish-grey, which in places is porphyritic. Coarse-grained quartz, pink and grey feldspar, greenish biotite, and epidote are the principal minerals seen in the field. Near the northern margin of the batholith in Adair township, the granodiorite is markedly foliated, and in places crushed and granulated forming augen gneiss. Gneissosity and foliation of the granodiorite parallels the northern contact and the foliation of the Adair Volcanic Rocks.

Modal analyses of two massive leucogranodiorites are shown in Table II [Table 6, this report]. Albite and oligoclase grains are present in sample L-132. Oligoclase (An_{17-22}) is found as finely twinned subhedral to anhedral grains up to 6 millimetres wide, and in many places shows some zoning. Albite (An_{5-7}) is commonly untwinned, intricately zoned, and is present in subhedral to anhedral grains with about the same grain diameters as oligoclase. Friedlaender (1952)[3] noted the coexistence of albite and oligoclase in litchfieldite from the Blue Mountains, Ontario, but reports of other similiar findings are rare. Coexistence of albite and oligoclase in the same rock may be due to unmixing of low temperature oligoclase as suggested by Laves (1954)[4].

Potash feldspar and some quartz are interstitial to plagioclase; much of the quartz is present as large grains up to 3 millimetres wide. Potash feldspar, in places perthitic, is rarely altered and shows scotch-plaid twinning typical of microcline. Biotite, epidote (pistacite), and rare chlorite are associated with altered dark green amphibole. Accessory minerals are sphene, zircon, pyrite, and apatite.

Dikes ranging from less than 1 foot to 100 feet wide, and consisting mainly of foliated granodiorite with some aplite, granite pegmatite, and rare feldspar porphyry, are found in the Adair Volcanic Rocks up to 350 feet north of the north contact of the Patten River Pluton. Some of these granodiorite and pegmatite-aplite dikes are contorted, of boudinage form, and concordant with the Adair Volcanic Rocks. Foliation in the Adair Volcanic Rocks is locally contorted in the vicinity of the dikes.

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[1]Mawdsley, J.B.
1930: Desmeloizes Area, Abitibi District, Quebec; Geol. Surv. Canada, Summary Rept. 1928, pt. C, pp. 28c-82c.

[2]Flaherty, G.F.
1939: Perron-Rousseau Sheet; Geol. Surv. Canada. Scale, 1 inch to 1 mile.

[3]Friedlaender, C.
1952: Alkaligesteine von Blue Mountains, Ontario; Schweiz. Min. Petr. Mitt., Vol. 32, pp.213-42.

[4]Laves, F.
1954: The coexistence of Two Plagioclases in the Oligoclase Compositional Range; Jour. Geol., Vol. 62, pp. 409-11.

TABLE 6: MODAL ANALYSES OF GRANODIORITE OF THE PATTEN RIVER PLUTON[1]

Specimen No.	Locality	Quartz	Plagioclase	Potash Feldspar	Biotite	Epidote	Accessories
L-132	0.6 miles east of Camp 24.	27.2	49.5	10.3	7.9	4.0	1.1
L-133	0.55 miles north of cabin at northern foot of Portage Hill.	30.0	46.1	10.6	7.0	5.0	1.3

[1] Lumbers (1963, Table II, p. 23)

Rare quartz-feldspar porphyry and felsite dikes were mapped in the Adair Volcanic Rocks in the vicinity of Portage Hill.

To briefly summarize, mapping of the Patten River Pluton, both in Ontario and Quebec, indicates the presence of a moderately to intensely foliated border phase adjacent to the surrounding metavolcanics. In places along the north and east contacts, foliation and gneissosity are due to crushing and dip vertically to 45 degrees towards the centre of the pluton. The core and interior parts of the pluton are poorly exposed, but available data suggest that these parts are massive. Where the pluton is bordered by basic metavolcanics, numerous lens-shaped inclusions and hybrid rocks exist in the pluton adjacent to the contact; but where it is bordered by acid metavolcanics, inclusions and hybrid rocks are apparently lacking. Granitic, aplitic, and pegmatitic dikes are common in the surrounding metavolcanics up to ½ mile from the contact. In places along the north contact in Adair township, these dikes are deformed.

BATEMAN LAKE PLUTON

The eastern end of the Bateman Lake Pluton is centred on Payntouk Lake in eastern Tomlinson Township. The author was unable to examine these outcrops but B.C. Wilson (1979, p.20) visited the pluton and the following is his description.

Outcrops of massive to weakly foliated granitic rocks occur through-out the map-area. Weathered surfaces are white to light pink and fresh specimens are light to medium pink. The rocks are predominantly equigranular with grain sizes averaging from 1 to 3 mm. Locally, the rocks are porphyritic with up to 5 percent potassic feldspar phenocrysts as large as 1 cm. An average composition of 22 percent quartz, 54 percent plagioclase, 17 percent potassic feldspar, and 7 percent dark and accessory minerals for the rock was obtained by point counting stained hand specimens. Thin sections reveal the accessory minerals to be chlorite, biotite, apatite, epidote, sphene and opaque minerals. Plagioclase determinations on two sections give a value of An_{22}.

HURTUBISE STOCK

The trondhjemitic Hurtubise Stock is found in the southwestern part of Hurtubise Township and has very little outcrop. The trondhjemite is medium grained, massive, crystalline with a whitish grey weathered surface and a grey fresh surface. A slab of the trondhjemite stained by the author, contained 55 percent plagioclase, 35 percent quartz, 6 percent potassium feldspar, and 4 percent biotite.

SCAPA STOCK

The Scapa Stock is a pink granite that has intruded the Scapa Metasediments in the northwestern part of Scapa Township. It is medium grained, uniform, and pink in appearance. The composition is about 40 to 45 percent potassium feldspar, 25 percent plagioclase, 20 to 25 percent quartz, 6 to 10 percent biotite, and accessory muscovite, chlorite, epidote, sphene, zircon, and opaque minerals.

The remaining unnamed quartz monzonite batholith separates the northern and southern supracrustal belts. Outcrop is scarce but, except for contact areas, the composition appears uniform throughout. The rock is salmon pink on both weathered and fresh surfaces. It is massive, medium grained, crystalline and composed of approximately 30 percent plagioclase, 30 percent potassium feldspar, 25 percent quartz, and 5 percent biotite. Minor pegmatite lenses have been found within the batholith.

A small intrusive plug on the east side of Hopper Lake is composed of quartz diorite. It is coarse grained to very coarse grained, equigranular to porphyritic, and massive with small shear planes throughout. In the porphyritic variety, feldspar crystals up to 1 cm are seen. The mafic minerals are biotite and hornblende and compose up to 40 percent of the rock. The ratio of hornblende to biotite varies from predominantly hornblende to predominantly biotite with all possible combinations in between. Zoned plagioclase was recognized from weathering patterns in the crystals.

Mafic to Intermediate Intrusive Rocks

The mafic to intermediate intrusive rocks are not common in the map-area. The diorite body that is found around Detour Lake was deduced, primarily, by using ODM-GSC aeromagnetic maps (ODM-GSC 1963a,b,c,d, and e) and a limited number of outcrops. The outcrops of diorite along the Patten River in St. Laurent Township is interpreted to be of limited extent and may be a phase of the Mistawak Batholith.

The Detour Lake diorite is mesocratic, coarse grained, inequigranular, crystalline, and massive. It has a salt-and-pepper fresh surface and a dark grey weathered surface. The mafic component consists of approximately 60 percent hornblende and biotite in almost equal amounts. The rest of the rock is composed of 35 percent plagioclase (An_{22}) and 5 percent quartz. A leucocratic hornblende diorite to monzonite phase was found within the diorite.

The small diorite plug on the Patten River is coarser grained than the Detour Lake diorite. The outcrop is leucocratic and contains large rafted xenoliths of mafic metavolcanic rocks (Photo 4). This massive crystalline diorite contains 65 percent plagioclase, 30 percent combined amphibole and biotite, and 2 percent quartz. The hornblendes have chloritic alteration rims.

OGS 10 219

Photo 4–Rafted xenoliths of mafic metavolcanic rock caught up in a diorite on the Patten River in St. Laurent Township.

LATE PRECAMBRIAN (PROTEROZOIC)

Mafic Intrusive Rocks

QUARTZ DIABASE

Quartz diabase dikes are found throughout the area but are not common. Except for the long, sinuous northeast-trending dike in the southern part of the area, all the exposed dikes trend approximately north. Fahrig *et al.* (1965) have dated north-trending dikes at 2485 million years and northeast-trending dikes at 1230 million years for this part of the Abitibi Belt. Both the northeast- and north-trending dikes are identical in appearance.

The dikes have no magnetic expression and cannot be traced beyond the outcrop area on which they are found. They are medium grained, massive, equigranular, and crystalline. They weather the characteristic reddish brown of diabase and have a black fresh surface. The quartz diabases contain labradorite (An_{50}) in micrographic intergrowths with quartz; the plagioclase is ophitically intergrown with euhedral to subhedral augite. The dikes are unaltered and unmetamorphosed.

STRATIGRAPHY

The stratigraphic succession proposed for the map-area is, by necessity, largely interpretive. A basic assumption was made and all structural interpretations are based on it. The assumption is that, in the southern belt, the mafic to intermediate metavolcanics near the south margin of the Mistawak Batholith form the base of the volcanic sequence and the felsic to intermediate metavolcanics overlie them and the clastic metasediments overlie both metavolcanic types. In the northern belt it was assumed that the complex, interbedded mafic to intermediate, felsic to intermediate metavolcanics and metasediments overlie the exposed mafic to intermediate metavolcanics.

In the southern supracrustal belt the possibility for two basal mafic to intermediate metavolcanic sequences exists. The Adair Volcanics have interdigitated mafic to intermediate and felsic to intermediate metavolcanics which pinch out to the northwest or become interfingered with the clastic metasediments; this comprises one metavolcanic sequence. The other sequence is found to the north of the Mistawak Batholith where the mafic to intermediate metavolcanics with minor interbedded felsic to intermediate metavolcanics is overlain by felsic to intermediate pyroclastic rocks with minor interbedded mafic to intermediate metavolcanics and metasediments. In the western part of the map-area, felsic to intermediate metavolcanics pinch out and the mafic to intermediate metavolcanics are overlain by clastic metasediments.

In the northern supracrustal belt the base of the sequence appears to be felsic to intermediate tuff with minor interbedded mafic to intermediate metavolcanics and metasediments. Overlying this is a predominantly metasedimentary horizon with interbedded mafic to intermediate and felsic to intermediate metavolcanics. The metasediments are overlain by the mafic to intermediate metavolcanics, interbedded felsic to intermediate tuffs, and ultramafic rocks. The unexposed complexly interbedded felsic to intermediate, mafic to intermediate metavolcanics and metasediments overlie the mafic to intermediate flows. Also overlying the flows, in the northwest are metasediments and mafic to intermediate flows which may be the lateral equivalent of the complex unit.

Phanerozoic

CENOZOIC

Quaternary

PLEISTOCENE

The Pleistocene geology of the map-area has been previously mapped on a reconnaissance scale by A.N. Boissonneau (1965). In addition to his Pleistocene

map there is a supplementary report (Boissonneau 1966). Lumbers (1962; 1963) in the course of his work in the southern part of the map-area described in detail the glacial deposits.

The depth of the Pleistocene overburden varies considerably within the area mapped by the author. A maximum overburden depth of 53 m has been recorded in diamond drill holes (Assessment Files Research Office, Ontario Geological Survey, Toronto). Figure 4 is a compilation of the depth of overburden measured in the diamond drill holes plotted on the geological map (back pocket). The ground surface is a gently rolling till and lacustrine plain and as such the great variability in the depth of overburden indicates a variable bedrock topography.

Glacial History

The first advance of the Wisconsinan ice over the map-area was in a southeast direction and a sandy till was deposited (Boissonneau 1966). This till has not been described within the map-area. This ice mass had withdrawn from much of the area by 8400 years B.P.[1] (Prest 1970). As the ice withdrew a proglacial lake developed between the Atlantic-Hudson Bay height-of-land and the ice front. The proglacial lake is known as Lake Barlow-Ojibway and varved clays, silt, and fine sands were deposited from it and underlie most of the map-area (Prest 1970; Boissonneau 1966). These glaciolacustrine deposits are only exposed in the southern part of the map-area. They are covered by the Cochrane till in the north (Figure 5). As this first ice front withdrew, subglacial streams developed within the ice sheet and eskers were formed. Kettle depressions, some of which are lakes, were formed within the eskers when buried stagnant blocks of ice melted.

About 8100 years B.P. (Prest 1970) the second phase of the Cochrane readvance covered the northern 85 percent of the map-area (Figure 5). This readvance modified and capped the eskers and Lake Barlow-Ojibway lacustrine deposits with a clayey till (Cochrane Till) and molded drumlinoid landforms with southeast orientations (Boissonneau 1966). Retreat of this ice mass was rapid and no extensive lake was formed during the post-Cochrane phase (Boissonneau 1966). The map-area was completely free of ice by 7800 years B.P. (Prest 1970).

Direction of Ice Movement

Striations found on water-washed outcrops throughout the area indicate a southeastward trend to the movement of the Wisconsinan ice sheet. The Cochrane readvance overrode the glaciolacustrine deposits of Lake Barlow-Ojibway and built drumlinoid features which also have a southeast trend indicating movement in that direction.

[1] B.P. stands for Before Present.

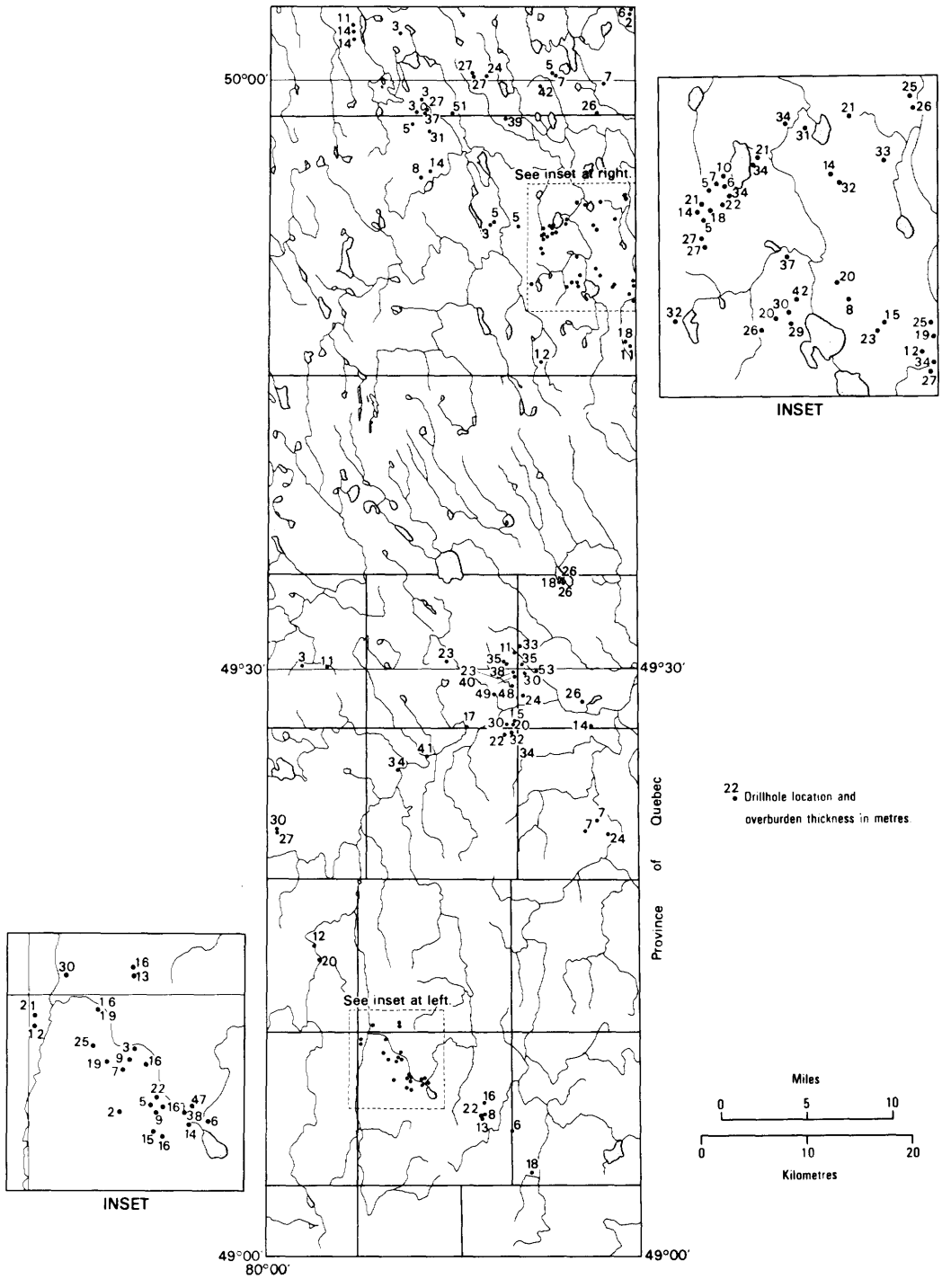

Figure 4–Depth of overburden taken from diamond drill logs (Assessment Files Research Office, Ontario Geological Survey, Toronto). Burntbush-Detour Lakes Area.

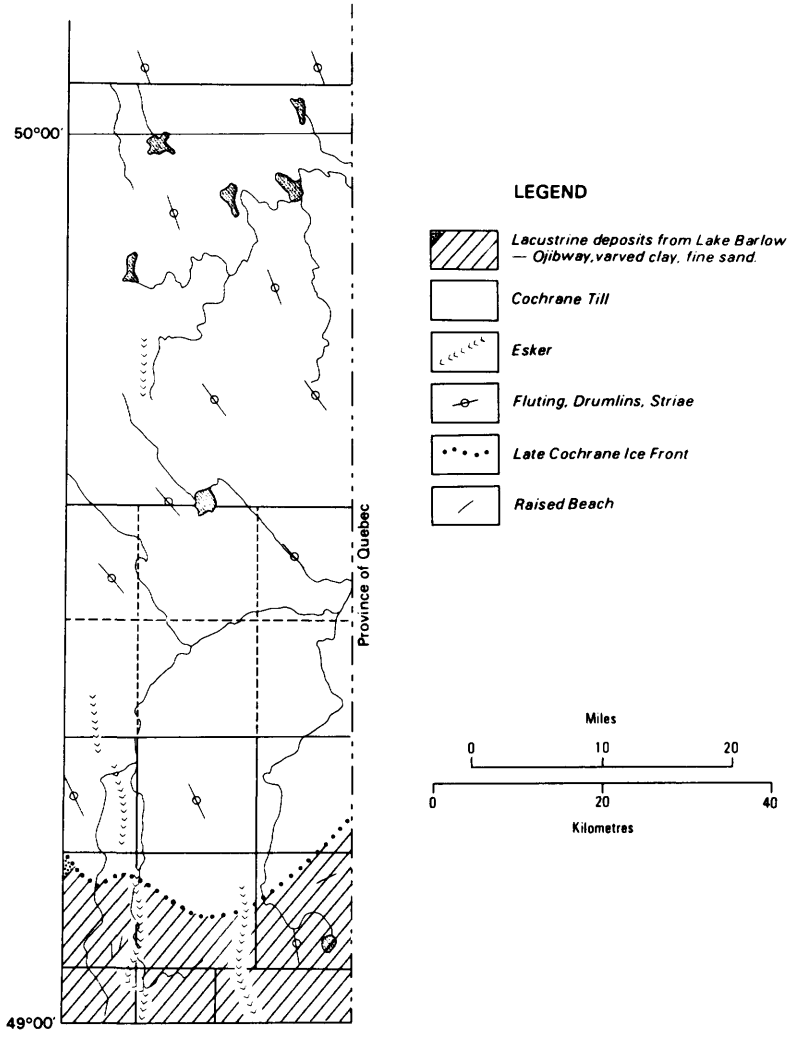

Figure 5–Surficial geology of the Burntbush-Detour Lakes Area. Map from Bennett *et al.* (1967).

Glacial Deposits

COCHRANE TILL

The Cochrane till which covers 85 percent of the map-area is a stratigraphic unit recognized over a considerable area (Prest 1970). Prest (1970, p.734) describes the Cochrane till as seen throughout its entire extent.

> The typical Cochrane till is a stone-poor, blue-grey clay till that rests on varved sediments. It takes on a very pale pinkish tint when weathered, and is a yellow-brown when oxidized. Being calcareous, it contrasts markedly with the older, sandy, and non-calcareous tills of the Timmins-Cochrane region (Hughes, 1965)[1]. The clayey character of the till is believed to be due mainly to the incorporation of lake clays as the Cochrane ice advanced southward.

Drumlinoid landforms and flutings are glacial features in the Cochrane Till that were molded by the ice mass of the Cochrane readvance. Typical drumlinoid features are about 1.6 km long by 530 m wide and are only about 3 m above their surroundings. (Boissonneau 1966). Similar features within the present map-area are much longer and tend to be narrower. Larger drumlins were noted in the Hopper-Detour Lakes area.

The drumlinoids are primarily composed of poorly sorted sand to granule gravel commonly with a margin of well sorted, clean gravel. The larger drumlins in the Hopper-Detour Lakes area are composed of poorly sorted coarse-grained sand with minor lenses of gravel.

Glaciofluvial Deposits

ESKERS

These are depositional features of subglacial streams active during the recession of the original Wisconsinan ice sheet. The eskers noted on Figure 5 and on the accompanying map (back pocket) are large discontinuous features up to 400 m wide and 20 to 30 m high. They have a very irregular kettle-like surface and are commonly covered with a 2 to 3 m veneer of Cochrane till.

The eskers found in Scapa and Abbotsford Townships have been modified by action of Lake Barlow-Ojibway whereas the eskers in Kenning and Tomlinson Townships have been modified by glacial overriding (Boissonneau 1965). The eskers are composed of well sorted, medium- and coarse-grained sand, gravelly sand, and coarse gravel with boulders.

Boissonneau (1966, p.574) explains the effect of the ice of the Cochrane readvance on the eskers.

> The persistence of eskers after they were overridden by an ice mass may be accounted for in part by the fact that the advancing ice mass moved parallel to the long axes of the eskers so that the le-

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[1]Hughes, O.L.
1965: Surficial Geology of Part of the Cochrane District, Ontario , Canada, Geol. Soc. Am., Spec. Papers No. 84.

velling action of the ice mass was minimal. To account for the surface relief of the clay till cap reflecting the broken relief of the underlying glaciofluvial deposits, Hughes (1959b)[1] suggested that buried ice blocks did not melt until some time after the eskers were overridden. However, a more or less uniformbly thick till sheet, slumped into kettle holes and smeared over swells, would mirror the broken topography of the underlying deposits.

Glaciolacustrine Deposits

VARVED CLAY, CLAY, AND FINE SAND

The lack of deep stream cuts and road cuts in the area precluded any detailed examination of varved clays. Lumbers (1962; 1963) described the varved clays as brown to blue grey and undeformed with varves ranging in thickness from 64 mm to 254 mm. Beds of unvarved clay, silt, and fine sand were seen interbedded within the varved clays. Figure 5 indicates the extent of exposure of the glaciolacustrine deposits within the map-area.

RECENT

Woody sphagnum peat and other organic material now collecting in muskegs form most of the Recent deposits. Some sediment is being deposited along stream valleys, and in places streams have eroded through the Cochrane till into the glaciolacustrine clays. This is most readily observable in the Kabika River in Kenning Township.

STRUCTURAL GEOLOGY

The metavolcanic-metasedimentary rocks of the southern and northern supracrustal belts lie at or within the noses of two fold structures which extend west from the main body of the Abitibi volcanic belt in Quebec. The southern supracrustal belt is an antiform produced by the doming effect of the emplacement of the Mistawak Batholith and Bateman Lake Pluton. Isoclinal folding was induced by interference between the felsic to intermediate intrusive bodies found within the southern belt. The northern supracrustal belt is isoclinally folded into an anticline and a series of antiforms and synforms. The emplacement of the Detour Lake diorite warped the fold axes and induced minor folding in the metavolcanics surrounding the body. Owing to the lack of outcrop, structural data within the map-area are rare. Most of the fold interpretation is therefore speculative and is biased toward the least stratigraphic complexity.

[1]Hughes, O.L.
1959b: Surficial Geology o the Smooth Rock and Iroquois Falls Map Areas, Cochrane District, Ontario; unpublished Ph.D. Dissertation, Univ. of Kansas, Lawrence, Kansas.

Major Features

FOLDS

In the Adair Volcanics on the south side of the dome a northwest-plunging anticline is assumed to exist between the Patten River Pluton and Abbotsford Lake. The repetition of metavolcanic lithologies in Abbotsford and Adair Townships and the presence of south-facing pillow tops are the basis for this assumption. The south-facing pillows seen by Lumbers (1963) and the south-facing sedimentary features seen by the author and Lumbers (1962; 1963) indicate that the south limb of the anticline is a homoclinal sequence, impart overturned, and terminating with the Steele Metasediments. In Kenning Township the metasediments are folded but not enough is known about the geology to enable the author to interpret fold axes.

The north side of the dome, in Hurtubise, St. Laurent, Bradette, and Noseworthy Townships, comprises a curvilinear, east-plunging synform and antiform pair. This interpretation is based upon the maintenance of a lithologic sequence of mafic to intermediate metavolcanics overlain by felsic to intermediate metavolcanics overlain by a thick sequence of clastic metasediments similar to the sequence on the south side of the dome.

The northern supracrustal rocks have been isoclinally folded about northwest-trending axes which have subsequently been deformed by the intrusion of the Detour Lake diorite. The anticline found north of Detour and Lower Detour Lakes plunges gently to the northwest at about 45 degrees (Paul Brown, Geologist, Amoco Canada Petroleum Company Limited, personal communication, 1978). The location of the axis of the anticline is delineated by lithological changes found in diamond drill logs and opposing pillow tops found on the north and south limbs. The remaining synforms and antiforms were interpreted in order to maintain a simple stratigraphic succession and explain the curved nature of the lithologic contacts.

FAULTS

Major faults or lineaments have not been proposed for the map-area because the amount of outcrop is insufficient and the overburden too deep for such interpretation. Three minor faults have been interpreted within the southern map sheet; two disrupt geology and one is interpreted from a break in the magnetic trend.

The inferred fault in the southeastern part of Abbotsford Township can be seen on the ODM-GSC (1978) aeromagnetic compilation map as a break in the magnetic trend. It is a dextral northeast-trending fault. An apparent north-northwest-trending fault along the Burntbush River in Noseworthy Township terminates the felsic to intermediate metavolcanics.

Minor Features

FOLIATION, SCHISTOSITY, AND GNEISSOSITY

The rocks of the metavolcanic-metasedimentary belts generally have foliation parallel or at a low angle to bedding. The foliation is defined by the planar orientation of platy and acicular minerals such as biotite, chlorite, muscovite, and amphibole and by flattening of clasts and pillows. Foliation is well developed in all the metavolcanic-metasedimentary rocks in the map-area. It follows or defines the major trend of the belts and is commonly dipping steeply. Foliation and bedding are disrupted by the Mistawak Batholith in Kenning, Hurtubise, and St. Laurent Townships. Foliation is seen approximately parallel to intrusive contacts southwest and west of Detour Lake. West of Sunday Lake foliation direction is variable.

Gneissosity is prevalent in the metavolcanic rocks near the contact of the Mistawak Batholith and Patten River Pluton. Gneissosity is defined by the layering of felsic and femic minerals. Xenoliths of volcanic material parallel gneissosity in the northern part of the batholith.

ECONOMIC GEOLOGY

Mineral exploration activity has been documented within the map-area since 1912 when gold was discovered on the Patten River (Tanton 1919, p.3). During the subsequent rush, prospectors failed to find any valuable deposits. Since that time the major emphasis has been toward base metal exploration. Activity has been sporadic since 1925 with increases in the late 1950s and mid 1960s, and recommencing in the early 1970s. Exploration has increased since 1974 with the announcement of a gold discovery by Amoco Canada Petroleum Company Limited in the vicinity of Sunday Lake.

The initiation of prospecting activity in 1925 was due to the discovery of copper-zinc mineralization at Normetal, Quebec. At that time the rocks that appeared to be most favourable for prospecting for base metals were the metavolcanic rocks in Adair Township which are structurally and lithologically similar to those rocks exposed at the Normetal Mine. Also examined during this period were the mafic metavolcanic rocks in Steele Township. Numerous sulphide "shear zones" were discovered and trenched but nothing of value was found (Lumbers 1962). In the early 1930s Cyril Knight did some prospecting for gold on a group of claims that were staked along the Burntbush River (Thomson 1936).

More recently the exploration activity for base metals has been concentrated in three locations. In order of decreasing interest these are: (1) the folded sequence of mafic to intermediate and felsic to intermediate metavolcanics and iron-rich metasediments in Adair and Abbotsford Township, (2) the interbedded felsic to intermediate, mafic to intermediate metavolcanics and metasediments in the vicinity of Vandette Lake, and (3) the felsic to intermediate metavolcanics in Bradette, Noseworthy, and Hurtubise Townships.

Three deposits of economic interest have been discovered within the map-area. 1) In Steele Township a spodumene-bearing pegmatite has been assessed for lithium and is held by Dex Limited (13) (Assessment Files Research Office, Ontario Geological Survey, Toronto). 2) A low-grade copper-nickel deposit was discovered in St. Laurent Township by Asarco Exploration Company of Canada (6) (Assessment Files Research Office, Ontario Geological Survey, Toronto). 3) In the Detour Lake area Amoco Canada Petroleum Company Limited (4) has outlined 10 million tons of 0.2 ounces gold per ton (Assessment Files Research Office, Ontario Geological Survey, Toronto). These three deposits will be discussed further under "Description of Properties".

During the present geological survey samples were collected for gold assay and thirty element qualitative spectrographic analysis. Quartz veins sampled for gold were greater than 25 cm wide and up to 8 m long. Two grab samples from two old pits in Steele Township and 22 rocks from elsewhere in the area underwent the spectrographic analysis.

Gold Occurrences

Three reported occurrences of gold have been noted within the map-area. Hopkins (1918, p.209) described a gold occurrence on the Patten River.

In 1913 gold was reported to have been found at the 30-foot falls near the mouth of the Patten River which is about two miles west of mileage 126 on the interprovincial boundary. Several claims were staked and some surface prospecting done. The rock in the vicinity is an altered quartz gabbro, which looks fresher than the Keewatin and older than the Keweenawan. The quartz veins are narrow, usually under six inches in width, and contain pyrite, calcite and occasionally low gold values. The vein on the last portage at the 30-foot falls was reported to contain some visible gold. The deposits appear to be of no economic importance. However, they are of interest in that they represent another locality in Ontario where gold has been found.

This is believed by the writer to be the same gold discovery mentioned by Tanton (1919). Thomson (1936, p.62) reported on a gold occurrence on the Burntbush River.

Some claims were staked by the Cyril Knight Prospecting Company on the east side of the Burntbush River, at the second long rapid about 4 miles above the Kabika river. A small amount of trenching and stripping was done during parts of 1931, 1932, and 1933, but the claims have since been allowed to lapse. Much of the area staked is drift-covered. Exposed rock consists largely of acid lava. Possibly some of the acid porphyritic rocks are intrusive and related to the granite, but if so they are lithologically very similar to others known to be flow rocks.

In places the rocks have been changed to schists and contain contorted quartz veins, which in places have been bent, broken, and pulled apart. These veins appear to be barren of gold, as shown by panning and assays. Trenching and stripping have been done principally on shear zones containing quartz-carbonate veinlets in altered acid rock, both containing pyrite. The trend is about E.10°S. The shear zones stand out more markedly where they intersect light-coloured massive rock than in the darker-coloured, more highly schisted rock. At the place where most of the work was done, a 6-foot zone, as described above, is bordered by fine-grained, massive rhyolite with disseminated fine-grained pyrite. The highest assay result obtained by C.F. Rice and J.D. Bateman (for the Cyril Knight Prospecting Company) was $2.00 per ton in gold[1]. A grab sample collected by the writer yielded no gold.

[1]$35.00/oz.

The grade of this showing was calculated by the present writer to be 0.06 ounces/ton. During the present survey this location was visited but the exact workings were not found. A sample from a quartz vein within the nearby metasediments was assayed by the Geoscience Laboratory, Ontario Geological Survey, Toronto and found to contain a trace of gold. The most important occurrence of gold is the Amoco Canada Petroleum Company Limited's gold deposit north of Detour Lake. The gold occurs both within the quartz veins and surrounding metavolcanic rocks and is associated with chalcopyrite mineralization. The property is discussed in detail later under "Description of Properties".

Samples of quartz veins taken by the field party throughout the area were all assayed by the Geoscience Laboratory, Ontario Geological Survey, Toronto, and all contained traces of gold.

Lithium Occurrences

Although pegmatites are common within the Case Batholith only one occurrence of spodumene bearing pegmatite has been found to date. This is the Dex Limited deposit in Steele Township and is described fully under the "Description of Properties". The company planned to recover the feldspars, mica, and possibly quartz. Two potential ore zones were delineated by trenching and drilling (Karvinen and Hunt 1976).

Iron Occurrences

Eight occurrences of iron have been reported by R. Shklanka (1968). Many of these have only been noted in diamond drill hole intersections and are commonly thin and interbedded with metavolcanic and metasedimentary rocks. Two of the occurrences are of interest but neither appear economic.

The Turgeon River occurrence is found in the northeastern part of Bradette Township and occurs in both Ontario and Quebec. This is an interlaminated magnetite ironstone–quartz iron formation with an eastward strike and steep dip. It was traced for a strike-length of 4200 m and has an estimated width of 120 m to 3600 m (Shklanka 1968, p.104) and an overall grade of 14 percent soluble iron. A single diamond drill hole in Bradette Township intersected 134 m of iron formation (logged as such) within which 36 m averaged 23.8 percent soluble iron, 27 m averaged 22 percent soluble iron, and 12 m averaged 23.4 percent soluble iron (Shklanka 1968). Most of the exploration on this occurrence has been on the Quebec side of the border.

The Kenning Prospect (Property 45) in the southeastern part of Kenning Township is the best described of the known iron occurrences. It is described fully in the "Description of Properties". The occurrence is a highly folded "iron formation" with interbedded magnetite, chert, wacke, and shale. It has a strike-length of 2,400 feet and an average width of 200 feet. The average yield of 25 grab samples was 24.5 percent iron. Davis magnetic tube tests of three samples between 20 and 33 percent iron at minus 100 mesh gave concentrates between 67 and 69 percent iron and 3 to 7 percent SiO_2 with 80 to 94 percent

percent iron recovery (Assessment Files Research Office, Ontario Geological Survey, Toronto).

Base Metal Occurrences

Since 1925 the main exploration target within the map-area has been for base metal mineralization. Areas of principal interest are the felsic to intermediate metavolcanic rocks found in: (1) Adair and Abbotsford Townships, (2) Bradette, Noseworthy, and Hurtubise Townships, and (3) the region around Vandette and Atkinson Lakes. Since the Amoco Canada Petroleum Company Limited's gold discovery north of Detour Lake exploration has increased in that particular metavolcanic-metasedimentary belt.

Several companies have done preliminary exploration work and follow-up diamond drilling. The anomalies that were drilled were mainly caused by both sulphide-bearing graphitic horizons and/or massive sulphide horizons. Pyrrhotite and pyrite were the predominant sulphide mineralization encountered. Many companies sent samples to be analyzed for Au, Ag, Cu, Zn, and Ni. The results on these analyses were uniformly disappointing. Even though significant amounts of pyrite and pyrrhotite were present, minerals of economic interest were not discovered.

Within the map-area two companies have reported concentrations of subeconomic base metals. In St. Laurent Township, Asarco Exploration Company of Canada has outlined a low-grade, low tonnage copper-nickel deposit. Nickeliferous pyrrhotite and chalcopyrite are concentrated in xenoliths of "dioritized andesite" which has been cemented by dioritic magma. According to company geologists the grade of this mineralization approaches economic values but the tonnage is too small to be considered economic (Assessment Files, Research Office, Ontario Geological Survey, Toronto). This property is described more fully under "Descriptions of Properties".

Gold mineralization within Amoco Canada Petroleum Company Limited's gold deposit north of Detour Lake is associated with minor chalcopyrite. Copper analyzed 0.2 to 0.3 percent (Paul Brown, Geologist, Amoco Canada Petroleum Company Limited, personal communication, 1978). The chalcopyrite is associated with pyrrhotite and pyrite both within the quartz veins and surrounding rocks.

Spectrographic Analysis

Twenty-four samples were submitted to the Geoscience Laboratory, Ontario Geological Survey, Toronto for 30 element qualitative spectrographic analysis. Two of those submitted were grab samples from a molybdenum prospect south of the Abitibi trans-limit road. One of these samples contained 0.01 to 0.1 percent of both beryllium and bismuth, and 0.05 to 0.5 percent of molybdenum as well as traces of chromium, manganese, vanadium, and zinc. Low to moderate amounts of titanium and iron were also noted. The other sample

taken from the prospect was identical except for the absence of beryllium and bismuth.

The remaining 22 samples were hand specimens of typical rock types occurring within the map-area and were submitted for whole-rock analysis. The samples submitted had no visible base metal mineralization yet many contained one or more traces of chromium, cobalt, copper, nickel, and zinc.

Mineral Exploration Potential

Despite the disappointing results from extensive exploration activity for base metals to date the writer is of the opinion that the potential for finding interesting economic mineralization within the map-area remains high. The discovery of gold north of Detour Lake by Amoco Canada Petroleum Company Limited raises the possibility that gold might be found in a similar situation within the northern part of the map-area. The Normetal Mine in Desmeloizes Township, Quebec is located within coarse-grained felsic pyroclastics which are down strike from the metavolcanics in Adair Township. Aside from the Normetal Mine numerous other copper and zinc showings occur in Desmeloizes Township and Perron Township to the north (M.R.N. Special Paper 2, 1967).

The area, in the writer's opinion, with the most potential for a base metal deposit is in Adair Township south of Joe Lake. Lumbers (1963) has reported finding coarse-grained intermediate pyroclastic metavolcanic rocks which according to D.F. Sangster (1972) are favourable for base metal deposits. The Normetal Mine is located in a similar environment, 11 km down strike to the southeast. These felsic metavolcanics extend further to the west, well into Abbotsford Township but become finer grained indicating a more distal facies and a lower possibility for massive sulphide deposits.

The interbedded felsic to intermediate, mafic to intermediate metavolcanic and metasedimentary sequence in the vicinity of Vandette and Atkinson Lakes has, in the writer's opinion, a reasonable potential for containing a base metal deposit. According to diamond drill logs (Assessment Files Research Office, Ontario Geological Survey, Toronto) the pyroclastic metavolcanic rocks are fine grained possibly representative of a distal facies. Even though these rock types are not considered to be favourable for base metal mineralization, the presence of barren sulphide mineralization either in graphitic horizons, massive beds, or disseminations indicates a suitable environment for the deposition of sulphide minerals. This area should continue to be explored as many conductors wait to be tested.

The felsic pyroclastic metavolcanic rocks in Bradette, Noseworthy, and Hurtubise Townships are predominantly of the fine-grained distal facies type. Although this area has not been explored to the same degree as the previously mentioned areas there appears to be fewer sulphide occurrences. Along the Burntbush River some coarse-grained pyroclastic rocks are found. The pyroclastic breccia may indicate a suitable horizon for base metal occurrence.

Since Amoco Canada Petroleum Company Limited was exploring for base metals when they discovered gold mineralization, it would appear that samples recovered from exploration projects should be routinely assayed for gold. The

gold in the Amoco deposit is believed by Amoco geologists to have been leached from the juxtaposed ultramafic rocks and to have been redeposited within quartz veins in tension fractures within a minor fold (see Property Descriptions). If this hypothesis is considered tenable, then any ultramafic rocks encountered in an exploration program should be examined for hydrothermal alteration that may have removed the gold. Care should also be taken to locate any nearby structural traps for the redeposition of the leached gold.

Description of Properties

The description of properties in good standing on December 31, 1978 are listed by the full name of the company or person who held the property. Descriptions of properties with a showing marked on the maps but no longer in good standing are listed by a name derived from the company or party who carried out the exploration work. An unclaimed parcel of explored land in which no mineral showings were located is listed by the full name of the company or person who held the land followed by the date in square brackets of the last major work.

All the following property descriptions, except for Amoco Canada Petroleum Company Limited's Detour Lake Deposit, are based on assessment work filed in the Assessment Files Research Office, Ontario Geological Survey, Toronto. The information contained in the Amoco's Detour Lake Deposit was provided by the company.

AMOCO CANADA PETROLEUM COMPANY LIMITED [1976] (1)

Amoco Canada Petroleum Company Limited formerly held several blocks of claims in the region between Latitudes 49°45′ and 49°55′ North and Longitude 79°45′ West and the Quebec border. These claim blocks are interpreted by the author to be underlain by interbedded felsic to intermediate, mafic to intermediate metavolcanics and metasedimentary rocks.

These claim blocks were staked over geophysical anomalies. Between 1974 and 1976 a total of 19 diamond drill holes were drilled for 10,972 feet to check bedrock conductors. The sources of these conductors were found to be either graphitic horizons or zones of up to 80 percent sulphide mineralization. The predominant mineral was pyrrhotite with associated pyrite. All the mineralized parts were sampled and analyzed. The results of these analyses were poor.

AMOCO CANADA PETROLEUM COMPANY LIMITED [1976] (2)

Amoco Canada Petroleum Company Limited formerly held several blocks of claims east of Hopper Lake and west of Detour Lake. The claims are interpreted by the writer to be underlain by metasediments with some interbedded mafic metavolcanics.

TABLE 7: INFORMATION ON PROPERTIES IN THE BURNTBUSH-DETOUR LAKE AREA ON FILE WITH THE ASSESSMENT FILES RESEARCH OFFICE, ONTARIO GEOLOGICAL SURVEY TORONTO, AS OF DECEMBER 31, 1978.

File Name	Township or Area	Property Reference Number	Type of Work
Amoco Canada Petroleum Co. Ltd.	Atkinson Lake, Lower Detour Lake	1	DDH
Amoco Canada Petroleum Co. Ltd.	Hopper Lake	2	M, EM, DDH
Amoco Canada Petroleum Co. Ltd.	Sunday Lake, West of Sunday L.	3	DDH
Amoco Canada Petroleum Co. Ltd.	Sunday Lake	4	DDH, X-Sec.
J.R. Mowat (Asarco Expl. of Can.)	Hurtubise Tp.	5	M, EM, DDH
Asarco Exploration of Canada	St. Laurent Tp.	6	M, EM, IP, G GR, DDH
Canadian Superior Exploration Ltd.	Adair, Abbotsford Tps.	7	M, EM, GV, G, DDH
Canadian Superior Exploration Ltd.	Kenning Tp.	8	M, EM, DDH
Canadian Javelin Ltd.	Adair, Abbotsford Tps.	9	AM, AEM, EM, GR, DDH
Canadian Nickel Co. Ltd.	Lower Detour Lake, Hopper Lake, West of Sandy Lake	10	DDH
Conwest Exploration Co. Ltd.	Noseworthy Tp.	11	EM
Conwest Exploration Co. Ltd.	Atkinson Lake, Lower Detour L.	12	EM, DDH
Dex Limited	Steel Tp.	13	S, T, DDH
Dighem Syndicate	Adair Tp.	14	EM, DDH
Dome Exploration (Canada) Ltd.	Abbotsford, Case, Singer Tps.	15	AM, AEM, M, EM, DDH
Dome Exploration (Canada) Ltd.	Tomlinson Tp.	16	AM, AEM, M, EM, DDH
Dome Exploration (Canada) Ltd.	Bradette, Noseworthy Hurtubise	17	M, EM, DDH
Dome Exploration (Canada) Ltd.	Atkinson Lake	18	DDH
Falconbridge Nickel Mines Ltd.	Bradette Tp.	19	M, EM
Geophysical Engineering and Surveys Ltd.	Steel Tp.	20	DDH
Geophysical Engineering Limited	Hoblitzel Tp.	21	EM, DDH
Geophysical Engineering Limited	Noseworthy Tp.	22	DDH

Hudson Bay Expl. & Dev. Co. Ltd.	Kenning Tp.	23	EM
Hudson Bay Expl. & Dev. Co. Ltd.	Hurtubise, Noseworthy Tps.	24	EM
Hudson Bay Expl. & Dev. Co. Ltd.	Atkinson Lake, Lower Detour L.	25	M, EM, DDH
Jubilant Creek Mines Ltd.	Kenning Tp.	26	M, EM, GR
Kesagami Syndicate	Atkinson L., Lower Detour Lake, Hopper Lake	27	DDH
Mattagami Lake Mines	Steel Tp.	28	M, EM, GR
Noranda Exploration Ltd.	Hoblitzel Tp.	29	M, EM, DDH
Noranda Exploration Ltd.	Tomlinson Tp.	30	M, EM
Noranda Exploration Ltd.	Hurtubise, Noseworthy Tps.	31	M, EM
Noranda Exploration Ltd.	Bradette Tp.	32	M, EM, DDH
Noranda Exploration Ltd.	Atkinson Lake	33	M, EM
Noranda Exploration Ltd.	Hopper Lake, Lower Detour Lake	34	M, EM, DDH
Noranda Exploration Ltd.	Sunday Lake, west of Sunday L.	35	M, EM
Ogryzlo, S.P.	Bradette Tp., west of Sunday L.	36	M, EM
Onshore Petroleum Ltd.	Bradette Tp.	37	M, DDH
Penarroya Canada Ltd.	Hopper Lake, Lower Detour L.	38	M, EM
Rio **Tinto** Canadian Expl. Ltd.	Bradette, Noseworthy St. Laurent Tps.	39	M, EM, GV, DDH
Rio **Tinto** Canadian Expl. Ltd.	Atkinson Lake	40	M, EM, GV, DDH
Sarafand Development Co. Ltd.	Sunday Lake	41	M, EM
Selco Exploration Co. Ltd.	Atkinson Lake	42	DDH
Silverplace Mines Ltd.	Adair Tp.	43	M, EM
Stanford Mines Ltd.	Abbotsford Tp.	44	M, EM, DDH
Triona Exploration Ltd.	Kenning Tp.	45	M, EM, G, GR
United States Smelting, Refining & Mining Co.	Hurtubise Tp.	46	M, EM, DDH

Abbreviations used:

DDH	Diamond Drilling	M	Magnetometer Survey
G	Geological Map	EM	Electromagnetic Survey
GR	Geological Report	IP	Induced Polarization Survey
GV	Gravity Survey	S	Stripping
AM	Airborne Magnetometer Survey	T	Trenching
AEM	Airborne Electromagnetic Survey	X-sec.	Cross Sections

These claims were staked over geophysical anomalies. In 1974 and 1976 a ground geophysical survey was carried out over the claims east of Hopper Lake. These surveys discovered one weak conductor and several magnetic anomalies. A single 436 foot diamond drill hole was sunk to test the anomaly and it intersected metasediments with disseminated mineralization. The analysis results were poor. West of Detour Lake two diamond drill holes totalling 1,214 feet were drilled in 1974. These holes intersected interbedded metasediments and metavolcanics locally containing up to 10 percent disseminated pyrite and pyrrhotite. The analysis results were poor.

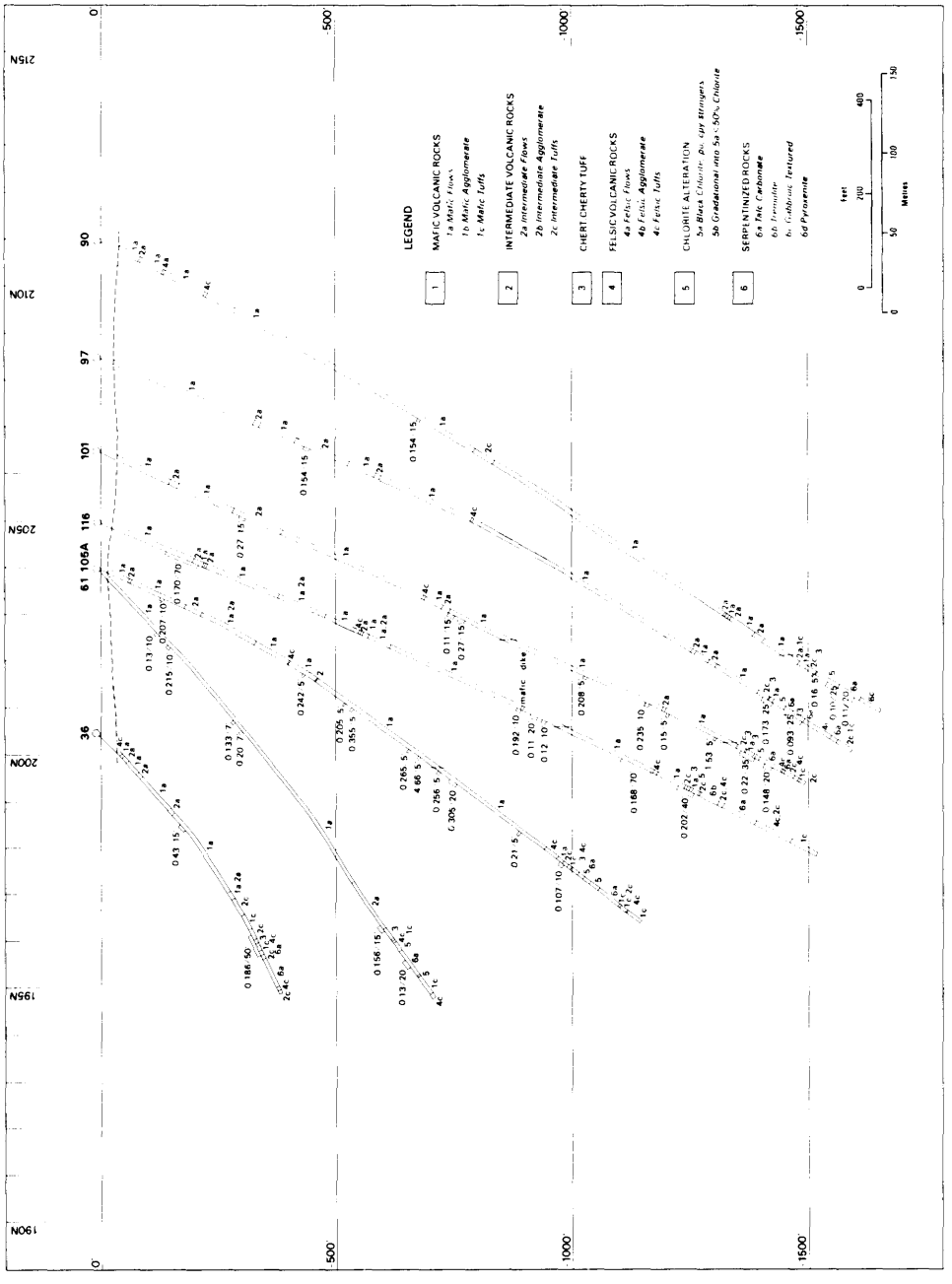
AMOCO CANADA PETROLEUM COMPANY LIMITED (SUNDAY LAKE PROPERTIES) (3)

In 1978 Amoco Canada Petroleum Company Limited held 351 unpatented claims north of 50°00′ North Latitude and between the Quebec border and 79°47′ West Longitude. These claims are numbered as such; P388485 to P388487 inclusive, P400980 to P400983 inclusive, P401006, P401007, P401010 to P401013 inclusive, P401015 to P401023 inclusive, P421280, P421281, P421285 to P421380 inclusive, P421385, P421390, P421395 to P421489 inclusive, P421728 to P421749 inclusive, P421761 to P421782 inclusive, P421794 to P421843 inclusive, P421860 to P421863 inclusive, P421893 to P421912 inclusive, P429745 to P429760 inclusive. Within this large group of claims there are 24 leased claims covering the Amoco Gold Deposit which will be discussed next. Metasediments are interpreted by the author to underlie the southwestern part of this claim group; elsewhere mafic metavolcanics are interpreted to be the predominant rock type.

To check geophysical anomalies nine exploration diamond drill holes were sunk for a total of 4,056 feet. These holes were drilled between 1974 and 1976. These diamond drill holes intersected mafic metavolcanic flows, and tuffs with minor interbedded felsic to intermediate metavolcanics. Locally the mafic metavolcanics contain thin horizons with up to 80 percent pyrite-pyrrhotite mineralization. Analysis results reported for Au, Cu, Zn, and Ni are uniformly disappointing. Much of the exploration work done on these claims has not been submitted for assessment credit.

AMOCO CANADA PETROLEUM COMPANY LIMITED (DETOUR LAKE DEPOSIT) (4)

In 1978 Amoco Canada Petroleum Company Limited held 24 leased claims located 15 km north of Detour Lake. The numbers of the leased claims are: P400974 to P400979 inclusive, P401008, P401009, P401014, P421282 to P421284 inclusive, P421381 to P421384 inclusive, P421386 to P421389 inclusive, P421391 to P421394 inclusive. This gold deposit, discovered in 1974, is centred on the co-ordinates 50°00′50″ North Latitude and 79°42′20″ West Longitude.


LEGEND
1 MAFIC VOLCANIC ROCKS
1a Mafic Flows
1b Mafic Agglomerate
1c Mafic Tuffs
2 INTERMEDIATE VOLCANIC ROCKS
2a Intermediate Flows
2b Intermediate Agglomerate
2c Intermediate Tuffs
3 CHERT CHERTY TUFF
4 FELSIC VOLCANIC ROCKS
4a Felsic Flows
4b Felsic Agglomerate
4c Felsic Tuffs
5 CHLORITE ALTERATION
5a Black Chlorite-pyrite Stringers
5b Gradational into 5a>50% Chlorite
6 SERPENTINIZED ROCKS
6a Talc Carbonate
6b Tremolite
6c Gabbroic Textured
6d Pyroxenite
61 105A
36
116
101
97
90
215N
210N
205N
200N
195N
190N
0
500
1000
1500
Feet
Metres

The deposit was found as a result of an airborne geophysical survey carried out in the fall of 1974. The discovery anomaly was drilled and found to be caused by barren sulphide mineralization. These sulphide minerals carried gold values but little else (Northern Miner 1975). Exploration and surface development drilling was carried out from the fall of 1974 to mid 1976 and consisted of 129 diamond drill holes amounting to 136,000 feet. This drilling outlined 10 million tons of ore with an average grade of 0.204 ounces gold per ton cut (Northern Miner 1976).

In 1977 a major underground program to further explore and evaluate the deposit was commenced. The program consisted of a 2,500 foot long decline to the 396 foot level with over 1,000 feet of drifting and crosscutting (Northern Miner 1977). A 100 ton bulk sample was removed from three crosscuts through the main zone. In addition to the bulk sampling 30,030 feet of underground drilling was carried out at 25 foot intervals through the main ore zone. This drilling consisted of a fan of four EX drill holes at every station and an additional fan of three NQ drill holes at every second station (Don Deem, Senior Mining Engineer, Amoco Canada Petroleum Company Limited, Mining Division, personal communication, 1978).

The deposit is situated on the north limb of an anticline plunging gently to the west-northwest. The mineralized zone strikes 070 degrees , dips steeply, is up to 2,970 feet long, and has been proven to a depth of 495 feet. Mineralization has been intersected at a depth of 1,798 feet where assays averaged 0.49 ounces/gold per ton over 13 feet. The main mineralized zone is found within the hinge zone of a flexure in the north limb of the anticline. This flexure plunges 45 degrees to the west (Paul Brown, Geologist, Amoco Canada Petroleum Company Limited, personal communication, 1978). The dip of the main mineralized zone, steep near surface, becomes more gentle to the north at depth (see Figure 6).

Figure 7 is a generalized geological column showing the stratigraphic position of the main mineralized zone. The base of the sequence is a thick succession of arkosic metasediments with a few mafic flows. The metasediments grade upward into 1,000 feet of mafic tuffs which are overlain by 100 to 300 feet of felsic "agglomerate" (pyroclastic breccia). A further 100 feet of mafic tuff overlies the felsic metavolcanic horizon, which in turn is overlain by 10 to 300 feet of serpentinized mafic to ultramafic rocks, separated by 50 feet of felsic tuff. Overlying the serpentinized mafic to ultramafic rocks are 15 to 30 feet of intermediate tuff and cherty tuff. Capping this sequence are interbedded mafic flows and intermediate to mafic flows which are greater than 1,000 feet in accumulated thickness. Total thickness of the stratigraphic column is greater than 2,730 feet. The volcanic sequence is cut by metamorphosed mafic dikes and sills.

The main mineralized zone incorporates the basal part of the mafic flow sequence, the upper part of the ultramafic zone, and intervening intermediate tuff horizon. Figure 6 is a composite section (line 186E, 187E, and 188E) taken from the drill hole sections submitted by Amoco Canada Petroleum Company Limited for assessment credit. Holes 36 and 61 occur solely in the plane of section 186E whereas holes 105A, 116, 101, 97, and 90 are only in this plane above the short vertical line drawn through the holes. The continuation of these holes is in section 187E and except for hole 101 terminate in the plane of this section. In hole 101 below the second vertical line the hole continues into the plane of

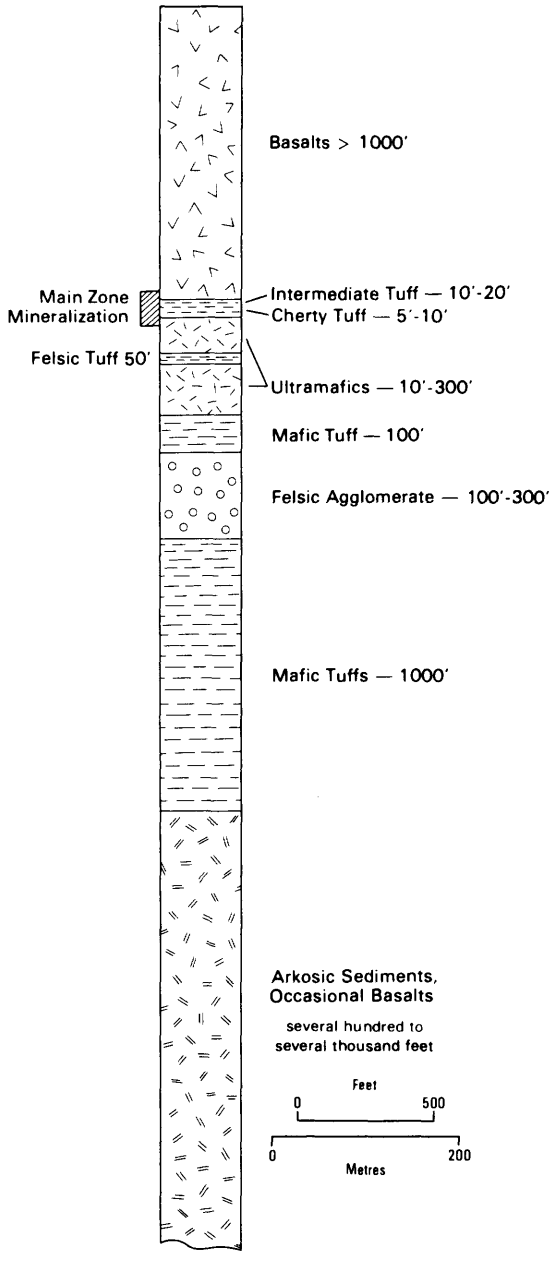


Figure 7–Generalized Geological Column through the Detour Lake Gold Deposit. Information from Amoco Canada Petroleum Company Limited.

section 188E. Above the main zone of mineralization there are three minor zones of quartz veins which carry gold values. The most important of these is found 300 feet stratigraphically above the cherty tuff horizon and can be traced for 2,000 feet along strike. This zone extends from surface to an appreciable depth (Paul Brown, Geologist, Amoco Canada Petroleum Company Limited, personal communication, 1978). Further drilling is required to delineate these mineralized zones.

The gold in all mineralized zones is closely associated with chalcopyrite within both the quartz veins and surrounding metavolcanic host rock. The average grade of copper within the main mineralized zone is 0.2 to 0.3 percent. Pyrite and pyrrhotite are the predominant sulphide minerals. Between the "talc-carbonate" schist part of the ultramafic rocks and the cherty tuff (Figure 7) a variable thickness of chlorite alteration occurs (Figure 6). This black massive chlorite was once thought to be a high magnesium basalt (Paul Brown, personal communication, 1978). In the cherty tuff that has been brecciated by the quartz veins, potassic alteration in the form of pink potassium feldspar is common. The quartz pods and stringers have a predominantly northward-strike and short strike lengths.

Company geologists believe the gold mineralization is epigenetic and two models have been considered to explain its origin. Neither model has preference over the other.

One model explaining the origin of the gold is as follows. After deposition of the volcanic sequence and prior to folding, the gold was leached from the ultramafic rocks by circulating fluids which produced the carbonitization and serpentinization in the ultramafic rocks. These gold-bearing solutions migrated up section where they were trapped in the cherty tuff horizon. The primary sulphides in the cherty tuff caused the precipitation of the gold. The cherty tuff when analyzed has anomalous background values of gold compared to the surrounding rocks (Paul Brown, Geologist, Amoco Canada Petroleum Company Limited, personal communication, 1978). Subsequent folding, forming a flexure, created tension fractures. Synchronous with the folding a distant heat source remobilized the gold along with the quartz and chalcopyrite and reconcentrated them with quartz in the tension fractures in the hinge line of the flexure. Not all the gold-bearing fluids were trapped in this zone and three other zones of gold- and chalcopyrite-bearing quartz veining formed in pressure shadows further up section.

The second model is similar to the first and differs only in the time of initial emplacement of the gold in the chert. After the deposition of the lower mafic and ultramafic rocks, there was a quiescent period in the volcanism during which time the cherty tuff was deposited. Synchronous with the deposition of the chert, circulating hydrothermal fluids carbonatized and serpentinized the mafic and ultramafic rocks and leached the gold which was redeposited in the chert and sulphide minerals. This resulted in anomalous concentrations of gold within the chert. Volcanism then recommenced and deposited the overlying mafic metavolcanic rocks. The subsequent tectonic activity which remobilized the gold and chalcopyrite into the quartz veins is the same as in the first model.

ASARCO EXPLORATION COMPANY OF CANADA (MOWAT OPTION) [1966] (5)

James B. Mowat formerly held 12 claims in Hurtubise Township. These claims, in two groups, were at the confluence of the Burntbush and Kabika Rivers and 2 km up the Kabika River. These two claim groups are interpreted to be underlain by mafic metavolcanics with interbedded metasediments.

In 1966 Asarco optioned these claims and carried out a ground magnetic and electromagnetic survey. Six conductors were found on the two groups and two diamond drill holes were sunk for a total length of 700 feet. Both the holes intersected fine-grained metasediments with graphitic horizons.

ASARCO EXPLORATION COMPANY OF CANADA (ST. LAURENT DEPOSIT) (6)

In 1978 Asarco Exploration Company of Canada held 12 leased claims in central St. Laurent Township. These claims are numbered L87926 to L87937 inclusive and are underlain by mafic metavolcanic rocks.

Prior to 1965 Asarco discovered a zone of disseminated sulphide minerals. This discovery was evaluated by geological mapping and diamond drilling. In 1965, in order to further evaluate the discovery, an induced polarization, magnetometer, and electromagnetic survey was carried out over claims L87929 to L87933 inclusive. The I.P. anomaly and the magnetic anomaly were the same shape and were caused by disseminated magnetite. An electromagnetic anomaly was also outlined in the same region. This anomaly was substantiated by diamond drilling and found to be caused by stringers and disseminations of pyrite, pyrrhotite, and minor chalcopyrite. Two diamond drill holes were drilled in April of 1965 for a total of 696 feet and intersected minor pyrite and pyrrhotite mineralization. In the winter of 1966 five more diamond drill holes were drilled for a total of 3,181 feet to further check the zone outlined by previous drilling and geophysics.

In the winter of 1970, 143 claims, which included the original 12, were explored using magnetic and electromagnetic methods. The electromagnetic survey outlined one significant conductor which has been described in the previous paragraph. A number of weak, irregular responses were found which did not have any coincident magnetic expression. In June 1970 four of these conductors were tested with single diamond drill holes which totalled 1,350 feet in length. These drill results were disappointing since very little mineralization was encountered.

In the summer of 1970 a detailed geological survey was carried out over the entire 143 claims. The larger group is underlain by predominantly mafic metavolcanic rocks except for a coarse-grained diorite to quartz diorite intrusion in the northeastern part. A smaller mass of diorite centred on claim L87930 has been interpreted by Asarco geologists to be an apophysis of the larger diorite body. See Figure 8 for a detailed map of the 12 leased claims.

Near the northern contact of the small diorite body in the mafic metavolcanics is an "andesite-diorite" hybrid contact zone. This hybrid contact zone is

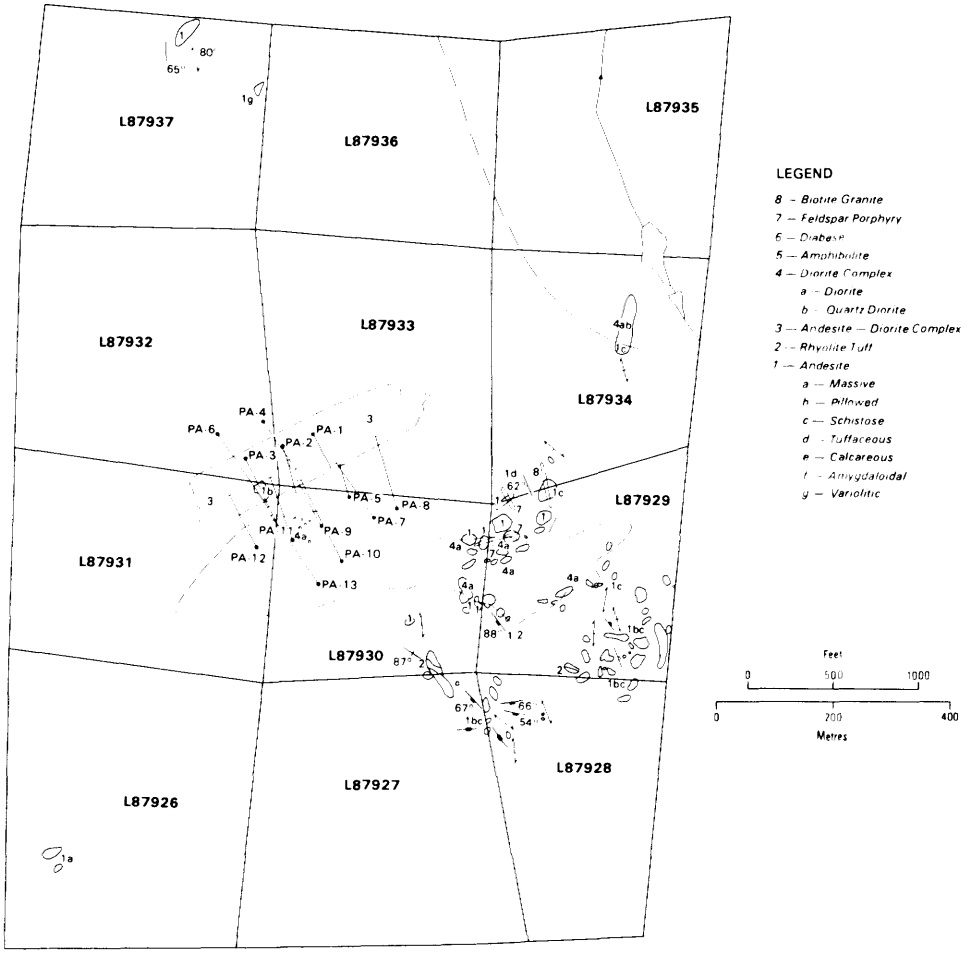


Figure 8–Geology of Asarco Exploration Company of Canada Limited's leased claims in St. Laurent Township. Geology by Asarco.

200 feet wide, strikes 060 degrees, and dips approximately 70 degrees to the south. The complex consists of fractured "dioritized andesite" blocks surrounded by coarse-grained diorite. These xenoliths of "dioritized andesite" contain nickeliferous pyrrhotite and chalcopyrite. The mineralized xenoliths are found in a narrow zone adjacent to the hanging-wall of the complex. Company geologists report that the grade of this mineralization approaches economic values but the tonnage is too small.

CANADIAN JAVELIN LIMITED [1965] (7)

Canadian Javelin Limited formerly held two claim groups in Adair and Abbotsford Townships. These two claim groups M-2 and M-3 were staked as the result of an airborne geophysical survey flown over 300 square miles in Adair, Abbotsford, and Hepburn Townships in 1962. The M-2 group consisted of 62 claims in Adair Township south of Joe Lake and the M-3 group consisted of 36 claims located along the southern part of the Adair-Abbotsford Township boundary. Both claim groups are underlain by intermediate to felsic metavolcanics with interlayered mafic flows.

The M-2 group contained one anomalous zone which was considered to be of no significance and no further work was done on the block.

The M-3 group contained six anomalous zones which were outlined for further exploration consisting of a ground electromagnetic survey, a geological survey, and diamond drilling to determine the source of the conductors. The diamond drilling consisted of 14 diamond drill holes with a total length of 4,234 feet. The conductors were pyrrhotiferous, tuffaceous mudstones within a sequence of felsic to intermediate metavolcanics. Mineralized parts from a few drill holes and outcrops of rusty amphibolite were analyzed and the results were discouraging.

CANADIAN NICKEL COMPANY LIMITED [1971] (8)

Canadian Nickel Company Limited formerly held claims in three separate localities in the northern part of the map-area. On the claims held, five diamond drill holes were sunk to test electromagnetic anomalies. A 380 foot deep diamond drill hole was sunk north-northeast of Detour Lake in very weakly mineralized interbedded metasediments and graphitic metasediments. A 345 foot deep diamond drill hole was sunk south of the east end of Hopper Lake and intersected very weakly mineralized mafic tuffs and metasediments. North-northwest of Hopper Lake three diamond drill holes were sunk for a total of 1,238 feet in weakly mineralized metasediments with some interbedded mafic metavolcanics.

CANADIAN SUPERIOR EXPLORATION LIMITED [1966] (9)

Canadian Superior Exploration Limited formerly held five claim groups in the southeast quadrant of Abbotsford Township and southwest quadrant of Adair Township. Underlying rock types are mafic metavolcanic flows interbedded with felsic to intermediate pyroclastics and minor metasediments.

These claim groups were explored using magnetic, electromagnetic, and gravimetric methods. One group had a geological survey carried out over it. Anomalies with varying degrees of potential were confirmed on each claim group. Those anomalies found in Abbotsford Township were tested with eight diamond drill holes totalling 2,317 feet in length. Mineralized sections containing up to 30 percent pyrrhotite and pyrite with poor analyses results were intersected.

CANADIAN SUPERIOR EXPLORATION LIMITED [1966] (10)

Canadian Superior Exploration Limited formerly held 34 claims in central Kenning Township. These claims are interpreted by the writer to be underlain by metasediments.

In 1966 a ground magnetic and electromagnetic survey was carried out and outlined three conductors. Two diamond drill holes were sunk for an accumulated depth of 739 feet. Metasediments with disseminated and locally massive pyrite and pyrrhotite were intersected. Analysis results were poor.

CONWEST EXPLORATION COMPANY LIMITED [1958] (11)

Conwest Exploration Company Limited formerly held a group of claims in the southwest quadrant of Noseworthy Township, east of the Burntbush River. These claims are interpreted by the author to be underlain by metasediments.

In 1958 a ground electromagnetic survey was carried out which outlined two good and several poor conductors. No further work is on record in the Assessment Files, Research Office, Ontario Geological Survey, Toronto, Ontario.

CONWEST EXPLORATION COMPANY LIMITED [1960] (12)

Conwest Exploration Company Limited formerly held a group of claims between Vandette Lake and the unnamed, narrow, north elongate lake south of Detour Lake. The underlying geology is interpreted by the present survey to be interbedded felsic to intermediate, mafic to intermediate metavolcanics and metasediments. Three claims were also held along the Quebec border east-southeast of Cuthbert Lake and are interpreted to be underlain by mafic metavolcanics.

In 1959 a ground electromagnetic survey outlined five strong conductors on

the property west of Vandette Lake. Nine diamond drill holes totalling 3,600 feet were sunk to check these conductors. The drilling encountered pyrite and pyrrhotite mineralization as disseminations, thin massive zones, and as stringers and blebs within graphitic horizons. Analysis results were not reported.

The three claims east-southeast of Cuthbert Lake had two diamond drill holes sunk in 1960 for a total depth of 611 feet. The diamond drill holes were in interbedded mafic to intermediate metavolcanics and metasediments. Pyrrhotite and pyrite mineralization was found to be disseminated and in blebs and stringers in both the metavolcanics and metasediments. Mineralized sections were sent for Au, Ag, Cu, and Zn analysis. The results were discouraging.

DEX LIMITED (STEELE LITHIUM OCCURRENCE) (13)

In 1978 Dex Limited held 31 unpatented claims numbering L459925 to L459945 inclusive, L354485 to L354487 inclusive, L363059 to L363061 inclusive, L363067, L363068, L354490. Four additional claims, L299568 to L299570 inclusive and L300983, were leased for 21 years effective November 1, 1976. The property is located southeast of Case Lake in Steele Township and is underlain by quartz monzonite and granodiorite, both with numerous pegmatite dikes.

Spodumene-bearing pegmatite was discovered and described by Lumbers (1962, p.30) and the following is his description.

> The spodumene-bearing pegmatite dike occurring in lot 5, concession V, Steele Township, is complex and zoned. This is the only complex pegmatite noted within the batholith. The pegmatite displays a narrow aplitic border phase in places and contains numerous quartz-rich patches, which appear to form the core of the pegmatite. Spodumene crystals, up to 3 feet long and 6 inches across, are most abundant in the quartz-rich patches. Columbite-tantalite, muscovite, and tourmaline are found with the spodumene. Molybdenite is rare.

Lumbers (1962, p.45) further describes the dikes as follows:

> The dike was traced in an east-west direction for a distance of 825 feet along strike, and it attains a maximum width of 100 feet. The dike grades into several quartz-rich stringers at its west end and is covered by vegetation and glacial debris at the east end of its outcrop area.
>
> The only mineral of economic significance in the dike appears to be the spodumene, which occurs as well-formed crystals up to 3 feet long and 6 inches in cross-section. The spodumene content of the dike is estimated at 10-15 percent. It is best developed in the quartz-rich core of the dike, although a few crystals were noted in pegmatite stringers extending from the dike into the surrounding quartz monzonite. A grab sample taken by the author from the dike assayed 0.65 percent lithium and showed a trace of beryllium. Carefully selected spodumene, assayed by the Provincial Assay Office, gave 7.63 percent Li_2O upon analysis.

Samples were submitted to the Mines Branch in 1963 by Canadian Johns-Manville Company Limited and were found to contain beryl crystals, spodumene, pollucite, and columbite-tantalite. Ore samples analyzed 0.37 percent BeO (Mineral Deposit File, Research Office, Ontario Geological Survey, Toronto, Ontario).

The now leased claims, were originally staked in 1971 by John Tesluk of Timmins and transferred to Leonard Darby the same year. In 1972 and 1973 the showing was stripped and trenched. In 1974 Leonard Darby transferred all

interests to Dex Limited who subsequently sank a 102 foot diamond drill hole to determine the depth of the spodumene mineralization. By 1975 two mineralized zones were delineated and a 4 km road was built to provide access to the property.

DIGHEM SYNDICATE [1977] (14)

Dighem Syndicate formerly held four claims, bisected by the south half of the Abbotsford-Adair Township boundary. The claims are interpreted to be underlain by felsic to intermediate metavolcanics with some interfingered mafic metavolcanics.

In 1977 the claims had a ground electromagnetic survey carried out on them and the single anomaly was tested with a 518 feet deep diamond drill hole. Mineralized zones with up to 10 percent combined pyrrhotite and pyrite were sent for analyses with negative results.

DOME EXPLORATION (CANADA) LIMITED (ABBOTSFORD LAKE PROPERTY) (15)

In 1978 Dome Exploration (Canada) Limited held 88 unpatented claims in the following locations: northeast corner of Case Township L429518 to L429520 inclusive, L429523; southwest quadrant of Singer Township L429645 to L429647 inclusive, L429650 to L429654 inclusive, and the northwest quadrant of Abbotsford Township L429510, L429515 to L429517 inclusive, L429625 to L429628 inclusive, L429631 to L429636 inclusive, L429572 to L429575 inclusive, L429578, L429564 to L429569 inclusive, L429580, L429581, L429584 to L429587 inclusive, L429591, L420882, L420885 to L420887 inclusive, L420890 to L420894 inclusive, L420896 to L420906 inclusive, L420910 to L420912 inclusive, L420942 to L420944 inclusive, L420948 to L420952 inclusive, L420954 to L420960 inclusive, L420962 to L420965 inclusive, L420972, and L420973. These claims are underlain by an isoclinally folded sequence of felsic to intermediate metavolcanics, metasediments, and mafic metavolcanics.

In 1975 an airborne geophysical survey was flown over the original claim group of 172 claims. A ground magnetic and electromagnetic survey was done in late 1975. The two geophysical surveys delineated nine conductive zones. The most interesting of these conductive zones is a zone of discontinuous conductors about 1,000 feet wide and 6 miles long. This anomalous zone was tested between 1976 and 1977 with 21 diamond drill holes totalling 7,818 feet in length. The conductors were found to be thin massive and disseminated horizons of pyrite and pyrrhotite. The massive sulphide horizons contained up to 50 percent pyrite and pyrrhotite in varying proportions. Analysis results on mineralized parts were up to 0.01 ounce/ton gold, and up to 0.1 percent copper with traces of zinc. Mineralization was confined to predominantly two rock types: "iron formation" and intermediate tuff.

DOME EXPLORATION (CANADA) LIMITED (TOMLINSON PROPERTY) (16)

In 1978 Dome Exploration (Canada) Limited held 35 unpatented claims in the southern part of Tomlinson Township. These claims are numbered as follows: L420993 to L420995 inclusive, L420998 to L421000 inclusive, L420915 to L420920 inclusive, L420922 to L420924 inclusive, L420927 to L420929 inclusive, L429529 to L429531 inclusive, L429534 to L429539 inclusive, and L429541 to L429547 inclusive. These claims are interpreted to be underlain by mafic to intermediate metavolcanics.

In 1975 a large area, which included the southern part of Tomlinson Township, was surveyed using airborne geophysical techniques. This survey indicated an east-trending structural zone with an associated series of conductors. Within the present map-area three diamond drill holes totalling 947 feet in depth were sunk in 1977. These diamond drill holes intersected intermediate to mafic tuffs with interbedded graphitic tuff horizons. Mineralized zones were analyzed for Au, Cu, and Zn with negative results.

DOME EXPLORATION (CANADA) LIMITED (BURNTBUSH RIVER PROPERTIES) (17)

In 1978 Dome Exploration (Canada) Limited held 31 claims in two groups. The northern group straddles the central part of the Noseworthy-Bradette Township line and are numbered: L347800, L347801, L347804, L347805, L347808, L347809, L347812, L347816, L367090, L367096 to L367108 inclusive. The southern group straddles the eastern edge of the Noseworthy-Hurtubise Township line and are numbered: L367115 to L367117 inclusive, L367120 to L367122 inclusive, and L367125 to L367127 inclusive. The southern group is interpreted to be underlain by felsic to intermediate metavolcanics and the northern group is interpreted to be underlain by a folded pod of metasediments within felsic to intermediate metavolcanics.

In 1973 a ground magnetic and electromagnetic survey was carried out on the two groups of claims. Numerous continuous conductive zones were encountered suggesting stratabound conductive material. To follow-up the geophysical exploration 15 diamond drill holes were sunk between 1973 and 1975 in Hurtubise, Noseworthy, and Bradette Townships. In Hurtubise Township three diamond drill holes totalling 861 feet were sunk into intermediate to felsic tuffs with up to 20 percent pyrite in disseminations and blebs. In Noseworthy Township seven diamond drill holes totalling 2,864 feet were sunk. Individual holes intersected primarily metasediments or intermediate to felsic tuffs both with graphitic horizons. Sulphide mineralization consisting of pyrite and pyrrhotite occur as fine disseminations, blebs, and bands in amounts up to 50 percent of the rock. In Bradette Township five diamond drill holes totalling 1,937 feet were sunk. Individual holes intersected primarily metasediments or intermediate to felsic tuffs. Mineralization was similar to that occurring in Noseworthy Township. A number of samples from each diamond drill hole were analyzed for Au, Ag, Cu, and Zn and the results were discouraging.

DOME EXPLORATION (CANADA) LIMITED [1970] (18)

Dome Exploration (Canada) Limited formerly held claims along the Quebec border east of the south end of Atkinson Lake. This area is interpreted to be underlain by mafic to intermediate metavolcanics.

A single 482 foot deep diamond drill hole was sunk in 1970 and intersected mafic metavolcanics interbedded with cherty mineralized zones and minor ultramafic rocks. The mineralized zones, 12 to 95 inches thick, are cherty tuffs with 20 to 30 percent pyrrhotite and pyrite, and minor chalcopyrite. The sulphide minerals occur as disseminations, blebs, and stringers. No gold or silver were found in the analyses but copper ranged from 0.06 to 0.24 percent and zinc ranged from a trace to 0.4 percent.

FALCONBRIDGE NICKEL MINES LIMITED [1976] (19)

Falconbridge Nickel Mines Limited formerly held 20 claims in Bradette and St. Laurent Townships south of the Burntbush River. The ground is interpreted to be underlain by felsic to intermediate tuffs.

In 1976 Falconbridge carried out a ground magnetic and electromagnetic survey over the ground which had been previously explored by Rio Tinto Canadian Exploration Limited (see Property Description No.39). The survey reaffirmed the location of Rio Tinto's anomaly and no further work was carried out.

GEOPHYSICAL ENGINEERING AND SURVEYS LIMITED [1957] (20)

A group of claims originally held by Marbano Mines Limited had further exploration work carried out on them by Geophysical Engineering and Surveys Limited. The part of the claim group formerly held by Geophysical Engineering is along the southern boundary of the map-area in the east half of Steele Township. Lumbers (1962, p.43-44) described the showing and the work accomplished.

The east showing is 2 chains north of the Trans-Limit road and may be reached by following a trail, 3 chains east of the gravel pits in lot 2, concession II, Steele Township. The west showing is 26 chains east and 8 chains north of mileage 56 on the Trans-Limit road.

Both showings are in gossan-capped shear zones within the Steele Volcanics. At the east showing, the shear zone area is about 5 chains wide, has an average strike of N70°W, and dips 80°N-70°S. The shear zone has been explored by four pits and two diamond-drill holes.

From the south, the first pit is 3 chains north of the Trans-Limit road, near the south boundary of the shear zone area. The pit is L-shaped and 3-10 feet deep. A drillhole, inclined at 50 degrees along N.51°E is at the elbow of the two arms of the pit, each of which are 6 feet wide and 20 feet long. A second pit, 4-10 feet wide, 60 feet long, and 10-15 feet deep, is 100 feet northeast of the first. A drillhole, inclined at 45 degrees along N.60°E., is situated at the south end of the pit. The third pit, 8 feet square and 3 feet deep, is 40 feet north of the second. A fourth pit occurs immediately north of the third and is 4 feet wide, 22 feet long, and 2-3 feet deep.

Amphibole schist, massive silicified rocks, and quartz stringers are common within the shear zone. Garnet is locally developed in amphibolite on the north border of the shear zone area, and porphyritic basalt occurs to the south. The mineralization, as seen in the four pits, consists of massive and disseminated pyrite and pyrrhotite, and rare disseminated chalcopyrite. Massive pyrite and pyrrhotite occur in layers, up to 8 inches thick, concordant with the strike and dip of the shear zone. Traces of copper, lead, zinc, nickel, gold, and cobalt were obtained from grab samples taken by the author for assay from each of the four pits.

Two shear zones, one 100 feet north and the other 60 feet south of the line separating claims L65287 and L65282, occur at the west showing. The northern shear zone strikes N.80°W. and dips vertically. It has an exposed width of 45 feet, and two pits, one 8 feet square and 4 feet deep and the other 2 feet wide, 18 feet long, and 3 feet deep, have been opened up. The shear has been further explored by a drillhole drilled south at an angle of 50 degrees at the first pit and another drilled S.6°W. at an angle of 64 degrees at the second pit. Massive pyrite, occurring in layers a few inches thick, is abundant. Disseminated pyrrhotite is common, and chalcopyrite is rare. Amphibole schist, quartz stringers, and silicified rocks predominate within the shear zone.

The southern shear zone, striking N.70°W. and dipping 80°N., is exposed in a pit, 3 feet wide, 30 feet long, and up to 5 feet deep. Amphibole-mica schist and narrow quartz stringers are host rocks to massive pyrite stringers and some disseminated pyrrhotite. Chalcopyrite is rare. A diamond-drill hole, drilled south at an angle of 56 degrees, is located at the north end of the pit.

Grab samples, collected by the author from each of the three pits showed traces, upon assay, of copper, lead, zinc, nickel, gold and cobalt. Drill core from the five holes drilled in the various showings was not available for inspection.

All the pits and diamond drill holes described by Lumbers are either in the map-area or close to the boundary of the map-area.

GEOPHYSICAL ENGINEERING LIMITED [1976] (21)

Geophysical Engineering Limited formerly held six claims in the central part of Hoblitzel Township and are interpreted to be underlain by metasediments. In 1976 a ground electromagnetic survey was carried out and a 251 foot deep diamond drill hole was sunk to test an anomaly. The rocks intersected were highly metamorphosed sediments with disseminated pyrite and pyrrhotite mineralization. The results from analyses were disappointing.

GEOPHYSICAL ENGINEERING LIMITED (Noseworthy Properties) (22)

In 1978 Geophysical Engineering Limited held 12 unpatented claims in three groups in the southeast quadrant of Noseworthy Township. They are numbered L362899 to L362902 inclusive, L437981 to L437986 inclusive, L393335 and L476881. The two claim groups on the eastern and southern borders are interpreted to be underlain by felsic to intermediate metavolcanics whereas the third group is interpreted to be underlain by metasediments.

In 1976 three diamond drill holes were sunk for a total depth of 881 feet. One hole was drilled in each claim group. The diamond drill hole near the Noseworthy-Bradette Township boundary intersected intermediate tuff with interbedded metasediments with up to 15 percent disseminated sulphide mineralization. The diamond drill hole near the Burntbush River intersected felsic to

intermediate metavolcanics with a 33 foot thick graphitic zone containing minor pyrite. The top 100 feet of this hole is badly fractured and altered to hematite and may be a fault zone. The final hole intersected metasediments with minor interbedded metavolcanics. Mineralization consisted mainly of pyrrhotite occurring within the metavolcanics in thin massive sulphide zones. Analysis results on all the mineralization in the three holes were discouraging.

HUDSON BAY EXPLORATION AND DEVELOPMENT COMPANY LIMITED [1976] (23)

Hudson Bay Exploration and Development Company Limited formerly held 23 claims in north-central Kenning Township which are interpreted to be underlain by mafic to intermediate metavolcanics in the north and metasediments in the south. Canadian Superior Exploration Limited had previously conducted a geophysical survey over the southern part of the claims (see Property Description No.8).

A ground electromagnetic survey was carried out in 1976 and located several anomalies. No further work was submitted for assessment credit.

HUDSON BAY EXPLORATION AND DEVELOPMENT COMPANY LIMITED (NOSEWORTHY PROPERTIES) (24)

In 1978 Hudson Bay Exploration and Development Company Limited held 26 unpatented claims in three groups: B-4, B-6, B-7. The B-4 group, L491140 to L491145 inclusive, is located in the south-central part of Noseworthy Township and is interpreted to be underlain by metasediments in the north and felsic to intermediate metavolcanics in the southern part of the claim group. The B-6 group, L491122 to L491139 inclusive, is in the central part of Noseworthy Township near the Hurtubise Township boundary, and is interpreted to be underlain by felsic to intermediate metavolcanics. The B-7 is in north-central Hurtubise and is interpreted to be underlain by mafic to intermediate metavolcanics.

A ground electromagnetic survey was carried out over these claim groups in 1977. A single, intermittent conductor was found in group B-4. Group B-6 has a strong anomaly in the north and a weaker one in the south and group B-7 has two strong conductors. No further work has been submitted for assessment credit.

HUDSON BAY EXPLORATION AND DEVELOPMENT COMPANY LIMITED (NASH LAKE PROPERTY) (25)

In 1978 Hudson Bay Exploration and Development Company Limited held a group of 21 claims numbered: P421083 to P421086 inclusive, P421143 to P421150 inclusive, P421152 to P421155 inclusive, P421179 to P421182 inclu-

sive, and P421188, northeast of Atkinson Lake. Hudson Bay formerly held 118 additional claims in five groups. These claim groups were in the region between the Quebec border and Longitude 79°43′ West and the Detour River and Latitude 49°45′ North. The claim group that is currently held by Hudson Bay is interpreted to be underlain by interbedded felsic to intermediate, mafic to intermediate metavolcanics and metasediments. Previous work has been done on some of these groups. In 1959 Conwest Exploration Company Limited did an electromagnetic survey along with subsequent diamond drilling southeast of Detour Lake. (see Property Description No.12). In 1968 Selco Exploration Company Limited did some diamond drilling northeast of Atkinson Lake (See Property Description No.42).

In 1975 Hudson Bay did a ground electromagnetic survey over their scattered claim groups. The only anomalies that were checked were in the claim group northeast of Atkinson Lake. In 1976 five diamond drill holes totalling 1,861 feet were sunk. All the diamond drill holes intersected felsic to intermediate metavolcanics with disseminated pyrrhotite and pyrite; locally up to 25-30 percent sulphide minerals were encountered. One graphitic schist contained up to 80 percent pyrrhotite and pyrite as blebs and stringers.

JUBILANT CREEK MINES LIMITED [1966] (26)

Jubilant Creek Mines Limited formerly held 18 contiguous claims in the southeast corner of Kenning Township. These claims are interpreted to be underlain by mafic to intermediate metavolcanics in the north and metasediments in the south.

In 1966 a ground magnetic and electromagnetic survey was carried out over the claim group. A geological survey was also carried out but failed to find any outcrop. The magnetic survey outlined a strong northwest-trending anomaly but no definite electromagnetic anomaly was found.

KESAGAMI SYNDICATE [1959] (27)

Kesagami Syndicate formerly held eight scattered claim groups in the northern part of the map-area. Six of these claim groups were in the vicinity of Vandette Lake in an area between the Detour River on the west, 4 km north and south of a line running east through the southern part of Vandette Lake 3.2 km to the east of Vandette Lake. The remaining two claim groups were southeast and south-southeast of Hopper Lake. The geology in the vicinity of Vandette Lake is interpreted to be interbedded mafic to intermediate, felsic to intermediate metavolcanics and metasediments. The geology of the group southeast of Hopper Lake is mafic to intermediate metavolcanics. The claim group south-southeast of Hopper Lake is interpreted to be in metasediments and felsic to intermediate metavolcanics.

In 1959 nine diamond drill holes totalling 2,699 feet were sunk on these claim groups. Sulphide mineralization encountered in drilling were dissemi-

nated pyrite and pyrrhotite in the metavolcanics and blebs and stringers of pyrite and pyrrhotite in the graphitic horizons. The two holes south-southeast of Hopper Lake encountered minor pyrite and pyrrhotite.

MATTAGAMI LAKE MINES (JARVI OPTION) [1976] (28)

Mattagami Lake Mines formerly held eight claims along the west boundary of the map-area in the northern part of Steele Township. The underlying rocks are mafic metavolcanics bounded by metasediments to the north and south.

During November 1975 to January 1976 a magnetometer and electromagnetic survey was completed on the group. Ten reasonable conductors with magnetic correlations were outlined. While prospecting the property two areas of exposed lenses of massive pyrrhotite and pyrite were found.

NORANDA EXPLORATION COMPANY LIMITED [1976] (29)

Noranda Exploration Company Limited formerly held 20 claims in the central and east-central part of Hoblitzel Township. Metasediments are interpreted to underlie the claims.

In 1974 a ground magnetic and electromagnetic survey was carried out outlining four conductors. In 1976 a 337 foot deep diamond drill hole was sunk to test the most promising conductors. The hole intersected metasediments with minor interbedded mafic tuff and minor disseminated pyrite and pyrrhotite.

NORANDA EXPLORATION COMPANY LIMITED [1974] (30)

Noranda Exploration Company Limited formerly held 10 claims in the southern part of Tomlinson Township adjacent to the west boundary of the map-area. The area is interpreted to be underlain by mafic metavolcanics.

In 1974 a magnetic and electromagnetic survey was completed over the area and a single conductor was outlined.

NORANDA EXPLORATION COMPANY LIMITED [1974] (31)

Noranda Exploration Company Limited formerly held 42 claims in five claim groups in northern Hurtubise Township and southern Noseworthy Township. The two claim groups east of the Burntbush River are interpreted to be underlain by metasediments whereas the two groups south of the Burntbush River are interpreted to be underlain by felsic to intermediate metavolcanics. The remaining group is interpreted to be underlain by mafic to intermediate metavolcanics. One of the claim groups south of the Burntbush River has had a

magnetic and electromagnetic survey plus diamond drilling done on part of it in 1969 by United States Smelting, Refining and Mining Company (See Property Description No.46).

In late 1973 and early 1974 Noranda completed ground magnetometer and electromagnetic surveys over the four properties. The claim groups in Hurtubise Township all possessed weak conductors without magnetic expression whereas the claim groups in Noseworthy Township had good conductors with correlating magnetic expressions.

NORANDA EXPLORATION COMPANY LIMITED (RUBE LAKE PROPERTY) (32)

In 1978 Noranda Exploration Company Limited held four unpatented claims: L400380 to L400383 inclusive, west of Rube Lake in Bradette Township. They previously held 38 claims in five groups in the southern two thirds of Bradette Township. All the claim groups except for the northern one are interpreted to be completely underlain by felsic to intermediate metavolcanics. The northern claim is bisected by the metasedimentary-metavolcanic contact. The claim group south of the Burntbush River on the west side of the township had a geophysical survey carried out on it in 1965 by Rio Tinto Canadian Exploration Limited (see Property Description No.39).

From November 1973 to September 1974 a ground magnetometer and electromagnetic survey was carried out on all five claim groups. All groups contained between 1 to 3 conductors, some with magnetic correlation. A 281 foot deep diamond drill hole was sunk in the claim group just north of the Burntbush River on the west side of the township in 1976. The diamond drill hole was in felsic to intermediate metavolcanics and intersected a 16 foot thick massive pyrite, with some interbedded black chert and graphitic tuff-breccia horizon. In April 1977 a 403 foot deep diamond drill hole was sunk near Rube Lake in felsic to intermediate metavolcanics with some graphitic horizons. Analysis results for Au, Ag, Zn, and Ni were disappointing.

NORANDA EXPLORATION COMPANY LIMITED (ATKINSON LAKE PROPERTIES) (33)

In 1978 Noranda Exploration Company Limited held six unpatented claims east and northeast of Atkinson Lake, numbered, P413913, P419098 to P419101 inclusive, and P419107. Previous to 1978, 29 claims in four groups were held in the region around Atkinson Lake. The remaining group, northeast of Nash Lake, is interpreted to be underlain by interbedded felsic to intermediate, mafic to intermediate metavolcanics and metasediments.

In 1976 a ground magnetometer and electromagnetic survey was carried out on all claim groups. The Nash Lake group has two conductors with sporadic magnetic correlation whereas the group east of Atkinson Lake has one conductor with weak magnetic correlation. No significant geophysical anomalies were detected on the remaining two claim groups.

NORANDA EXPLORATION COMPANY LIMITED (DETOUR LAKE PROPERTIES) (34)

In 1978 Noranda Exploration Company Limited held 33 unpatented claims in three groups, numbered: P413917 to P413919 inclusive, P413921 to P413924 inclusive, P420452, P420453, P414686, P414687, P414713 to P414716 inclusive, P414720 to P414722 inclusive, P411166, P424171 to P424174 inclusive, P424157 to P424162 inclusive, P424121, P424213, P424153, P424154. They formerly held 199 claims in eight groups located north of Detour Lake and south of Latitude 50°00′ North and from Hopper Lake east to the Quebec border. Two of these still valid claim groups are found north and east of Lower Detour Lake where they are interpreted to be underlain by metasediments and felsic to intermediate metavolcanics respectively. The third still valid group is east of Hopper Lake and is underlain by mafic metavolcanics.

From 1974 to 1976 ground magnetometer and electromagnetic surveys were carried out on all the claim groups. As a result of these surveys numerous conductors were found some of which had magnetic correlations. In 1977 and 1978 eight diamond drill holes totalling 3,330 feet were drilled to test the conductors in the claim groups north and east of Lower Detour Lake and east of Hopper Lake. Three holes drilled near Lower Detour Lake intersected intermediate to felsic metavolcanics to the east and metasediments to the north. Sulphide mineralization was not abundant and the analysis results were disappointing. Graphitic horizons appear to have been the cause of the conductors. Five holes drilled east of Hopper Lake intersected predominantly mafic metavolcanics except for one metasediment-rich hole. Pyrite and pyrrhotite were encountered as blebs and stringers in graphitic zones. Analysis results were disappointing.

NORANDA EXPLORATION COMPANY LIMITED (HOPPER LAKE PROPERTY) (35)

In 1978 Noranda Exploration Company Limited held six unpatented claims: P414640 to P414642 inclusive, P414729, P414734, and P414735, northeast of Hopper Lake. Noranda formerly held 93 claims in three groups found between Latitude 50°00′ and 50°04′ North and the Quebec border and Longitude 79°51′ West. All the former groups and present group are interpreted to be underlain by mafic metavolcanics.

During 1975 Noranda conducted ground magnetic and electromagnetic surveys on all groups. Eleven conductors were delineated, some with magnetic correlations. No further work has been submitted for assessment credit.

S.P. OGRYZLO [1975] (36)

S.P. Ogryzlo formerly held 27 claims in two groups. One group staked along the Quebec border in central Bradette Township is interpreted to be underlain by felsic to intermediate metavolcanics. The other group was staked west of Hopper Lake and is interpreted to be underlain by a large block of metasediments within the granitic batholith.

In 1975 Patino Mines (Quebec) Limited for S.P. Ogryzlo carried out a ground magnetic and electromagnetic survey. One conductor was found in Bradette Township and two were found west of Hopper Lake. No further work was submitted for assessment credit.

ONSHORE PETROLEUM LIMITED (BURTON GROUP) [1965] (37)

Onshore Petroleum Limited formerly held 16 claims on the northern boundary of Bradette Township. These claims are interpreted to be underlain by metasediments.

In 1965 a ground magnetic survey outlined an east-trending magnetic ridge which was tested by three diamond drill holes totalling 2,102 feet. The holes intersected metasediments with minor disseminated pyrite.

PENARROYA CANADA LIMITÉE [1972] (38)

Penarroya Canada Limitée formerly held a number of claim blocks covering ten anomalous zones discovered by an airborne geophysical survey flown in 1971. The claim blocks are found between Latitudes 49°52′30″ and 49°58′15″ North and the Quebec border and Longitude 79°50′ West. These claim blocks are interpreted to be underlain by mafic metavolcanics in the north and interbedded felsic to intermediate, mafic to intermediate metavolcanics and metasediments in the south.

Ground magnetic and electromagnetic surveys were completed in 1972 to check the airborne anomalies. Seven of the anomalies were interpreted to be caused by sulphide mineralization and three were interpreted to be caused by graphite.

RIO TINTO CANADIAN EXPLORATION LIMITED [1966] (39)

Rio Tinto Canadian Exploration Limited formerly held numerous claim groups in northern St. Laurent and Hurtubise Townships, southeastern Noseworthy Township, and the southern two thirds of Bradette Township. These claim groups are all interpreted to be underlain by felsic to intermediate metavolcanics.

During 1964 to 1965 Rio Tinto carried out a ground magnetic, electromagnetic, and gravimetric survey over these claim groups. Numerous anomalies were outlined. Three of the more interesting anomalies were checked in 1965 by diamond drilling. A single 300 foot diamond drill hole sunk on the Hurtubise-St. Laurent township boundary intersected felsic to intermediate tuff with a pyritiferous graphitic tuff horizon. Analysis results were all under 0.1 percent copper. The anomaly on the Hurtubise-Noseworthy township boundary was examined with two diamond drill holes totalling 693 feet. The two diamond drill holes were in felsic to intermediate tuff with graphitic tuff conductors. Analyses of pyrite mineralization were discouraging. A conductor along the St. Laurent-Bradette township boundary was tested with a 399 foot diamond drill hole and the conductor proved to be tuffaceous argillite horizons with disseminated pyrite. The analysis results were disappointing.

In early 1966 additional ground magnetic, electromagnetic, and gravimetric surveys were done to check some of the previous anomalies not diamond drilled. Three conductors were outlined, two with magnetic correlations but none with significant gravity correlation.

RIO TINTO CANADIAN EXPLORATION LIMITED [1966] (40)

Rio Tinto Canadian Exploration Limited formerly held three claims along the Quebec border east of Atkinson Lake. These claims are interpreted to be underlain by mafic to intermediate metavolcanics. In 1959 Selco Exploration Company Limited drilled a part of this property (see Property Description No.42).

In 1966 a magnetometer, electromagnetic, and gravity survey was conducted over the claims. A single conductor with a conformable magnetic anomaly was outlined. Two diamond drill holes were attempted but both were abandoned in the overburden.

SARAFAND DEVELOPMENT COMPANY LIMITED [1975] (41)

Sarafand Development Company Limited formerly held 30 claims east of Sunday Lake. These claims are interpreted to be underlain by mafic to intermediate metavolcanics.

In 1975 a ground magnetometer and electromagnetic survey outlined a single weak conductive zone. No further work was submitted for assessment credit.

SELCO EXPLORATION COMPANY LIMITED [1968] (42)

Selco Exploration Company Limited formerly held claims east and north of Atkinson Lake. Mafic to intermediate metavolcanics are interpreted east of Atkinson Lake and interbedded felsic to intermediate, mafic to intermediate me-

tavolcanics and metasediments are interpreted to be north of Atkinson Lake.

In 1959 three diamond drill holes were attempted on claims along the Quebec border east of Atkinson Lake. Two of the diamond drill holes were abandoned in overburden and the third, 535 feet deep, intersected mafic metavolcanics with blebs and stringers of pyrrhotite and pyrite. In 1968 two diamond drill holes, one east of Atkinson Lake and one north of Atkinson Lake, were drilled for a total of 1,076 feet. These holes intersected mafic metavolcanics with minor gabbros and talc schists. The diamond drill hole east of Atkinson Lake had an analysis of 1.4 percent combined Cu and Ni over 2 feet.

SILVERPLACE MINES LIMITED [1966] (43)

Silverplace Mines Limited formerly held 25 claims in the southwest quadrant of Adair Township and northwest edge of Hepburn Township. The ground is underlain by mafic metavolcanics with a wedge of intermediate to felsic metavolcanics in the middle part.

In 1966 a ground magnetometer and electromagnetic survey was carried out over the claims. Seven weak conductors with coincident magnetic anomalies were outlined.

STANFORD MINES LIMITED [1973] (44)

Stanford Mines Limited formerly held 30 claims in the northwest quadrant of Abbotsford Township. These claims are interpreted to be underlain by metasediments with a band of felsic to intermediate metavolcanics in the middle.

In 1972 Stanford Mines carried out a magnetometer and electromagnetic survey over the claims and outlined three strong conductors. In 1973 the conductors were tested with three diamond drill holes totalling 1,188 feet in length. The holes were all drilled in metasediments except for one which bottomed in felsic to intermediate metavolcanics. Narrow zones of pyrrhotite and pyrite, in combined amounts up to 80 percent, were found in all the holes. Analysis results were disappointing.

TRIANA EXPLORATION LIMITED (KENNING PROSPECT) [1957] (45)

Triana Exploration Limited formerly held 162 claims in the southeast part of Kenning Township. The ground is underlain by felsic to intermediate tuffs, metagreywackes, and "iron formation" folded into a Z-shaped structure.

In 1957 Triana carried out a ground magnetometer survey and a reconnaissance geological survey over the property. The ground was then optioned to Cliffs of Canada Limited who did magnetometer and geological surveys.

The magnetic "iron formation" occurs in lenticular pods and is distinctly banded and very contorted. The nonmagnetic part of the "iron formation" usually predominates wherever it occurs with the magnetic "iron formation".

The deposit is 2,400 feet long, averaging 200 feet in width, and strikes northeast. The "iron formation" is composed of banded magnetite separated by layers of quartz, mica, and amphiboles. The amphiboles are hornblende and grunerite in a ratio of 1:5. The magnetite is fine grained and constitutes from 20 to 50 percent of the rock.

The reserves calculated from the geological and magnetic surveys were estimated to be 40,000 long tons per vertical foot of magnetic material. An average of 24.5 percent iron was calculated from 25 grab samples. The phosphorus, sulphur, and titanium content is low. The apparent available tonnage was considered by Cliffs' geologists to be too low and no further work was recommended for the prospect.

UNITED STATES SMELTING, REFINING AND MINING COMPANY [1971] (46)

United States Smelting, Refining and Mining Company formerly held 16 claims in two blocks in the northeast quadrant of Hurtubise Township. The underlying rocks are interpreted to be felsic to intermediate metavolcanics by Burntbush River and mafic to intermediate metavolcanics on the claim block to the south.

A ground magnetometer and electromagnetic survey was carried out in 1969 by United States Smelting. The anomalies in the north block were caused by overburden and a series of well developed parallel anomalies were outlined on the southern block.

The United States Smelting, Refining and Mining Company subsequently withdrew from an agreement they had with Canadian Superior Exploration Limited and turned over all documentation to them. Canadian Superior then drilled two diamond drill holes for 1,459 feet in 1971 to test the south block anomaly. These holes intersected altered mafic metavolcanics containing scattered zones of disseminated pyrite.

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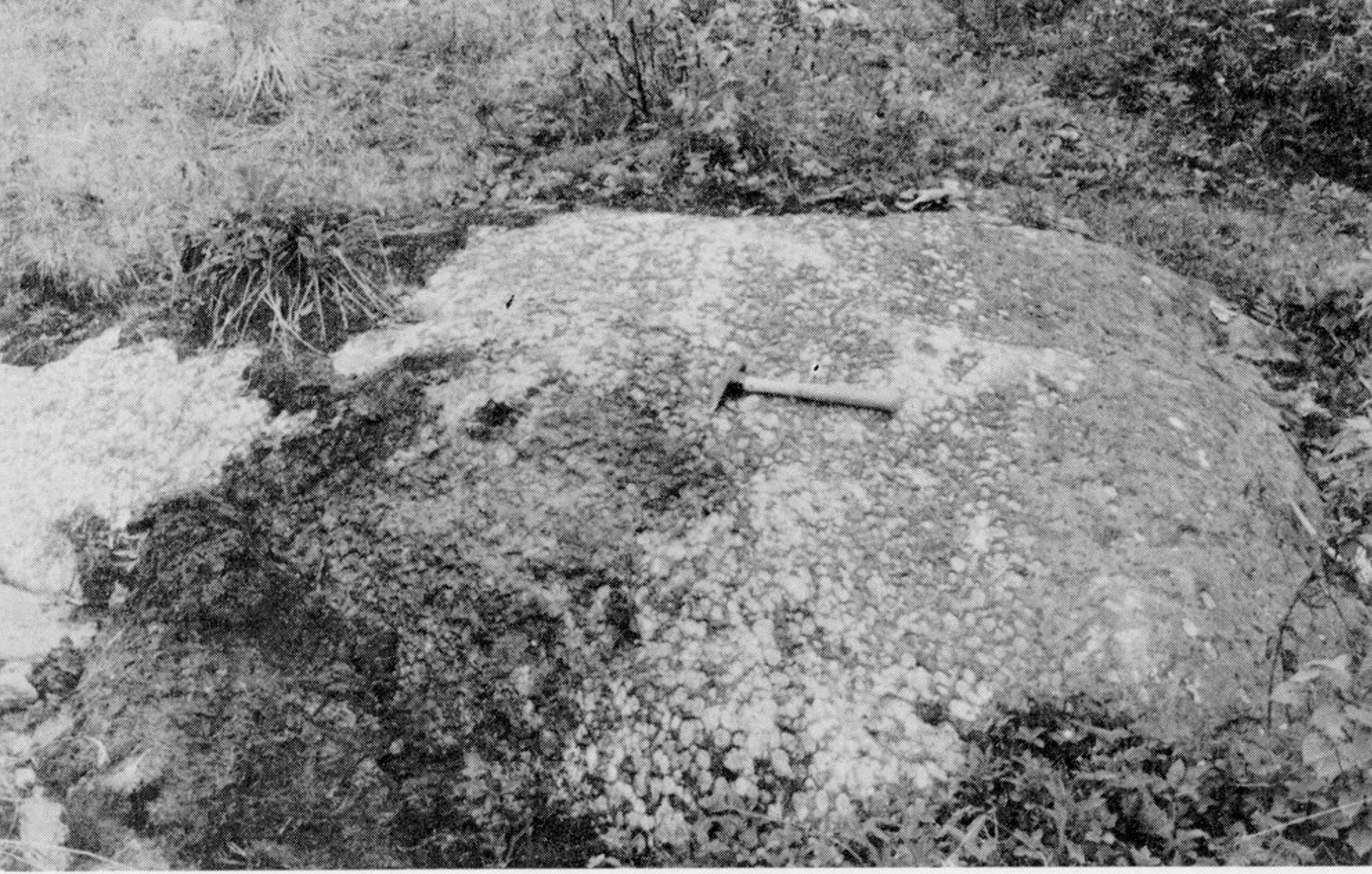

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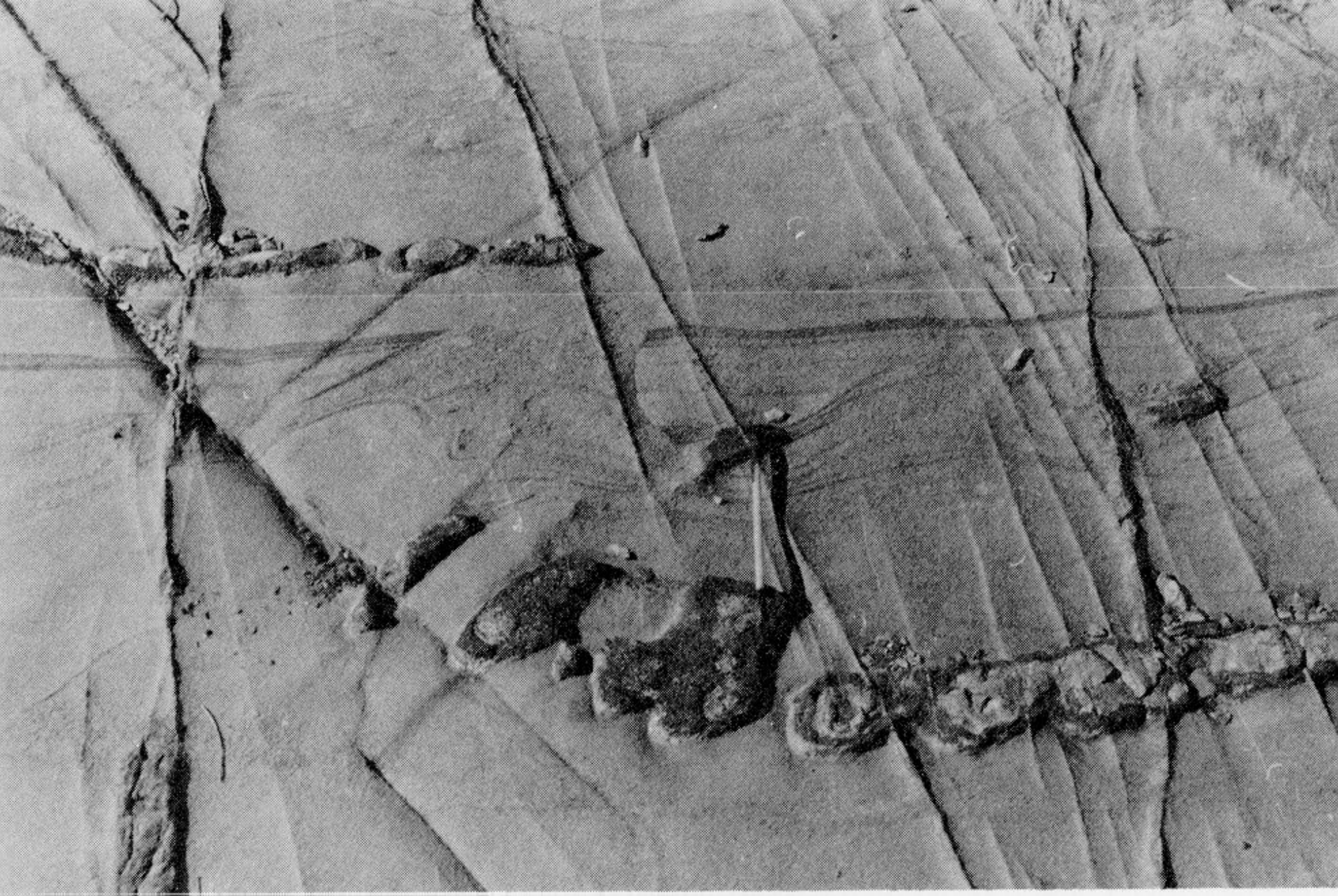


Ministry of Natural Resources

Ministry of Northern Affairs

Ontario

Ontario Geological Survey

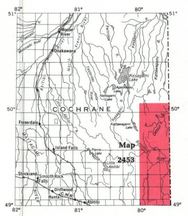
Map 2453

BURNTBUSH – DETOUR LAKES

COCHRANE DISTRICT

1:100 000

One centimetre represents one kilometre



SYMBOLS

- Glacial striae.
- Esker.
- Small bedrock outcrop.
- Area of bedrock outcrop.
- Bedding, top unknown; (inclined, vertical).
- Bedding, top indicated by arrow; (inclined, vertical, overturned).
- Lava flow; top (arrow) from pillows shape and packing
- Schistosity; (horizontal, inclined, vertical).
- Gneissosity, (horizontal, inclined, vertical).
- Foliation; (horizontal, inclined, vertical).
- Lineation with plunge.
- Geological boundary, observed.
- Geological boundary, position interpreted.
- Geological boundary; deduced from geophysics.
- Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.
- Jointing; (horizontal, inclined, vertical).
- Anticline, syncline, with plunge.
- Drill hole; (vertical, inclined). Overburden, depth in metres.
- Gravel pit.
- Other road.
- Trail, portage, winter road.
- Township boundary, approximate position only.
- Township boundary, unsurveyed, approximate position only.
- Provincial boundary, approximate position only.
- Mineral deposit, mining property, approximate position only.

LEGEND

PHANEROZOIC

CENOZOIC*

QUATERNARY

RECENT

Swamp, stream, and lacustrine deposits

PLEISTOCENE

Till, clay, sand and gravel deposits

UNCONFORMITY

PRECAMBRIAN[Be]

LATE PRECAMBRIAN (PROTEROZOIC)

MAFIC INTRUSIVE ROCKS

8 — *8a Quartz Diabase*

INTRUSIVE CONTACT

EARLY PRECAMBRIAN (ARCHEAN)

MAFIC TO INTERMEDIATE INTRUSIVE ROCKS

7 — *7 Unsubdivided*; *7a Diorite*

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

6 — *6 Unsubdivided*; *6a Quartz monzonite*; *6c Granodiorite*; *6c Pink granite*; *6d Quartz diorite*; *6e Feldspar porphyry; quartz feldspar porphyry*; *6f Granite gneiss*; *6g Pegmatite*; *6h Felsite*; *6j Trondhjemite*

INTRUSIVE CONTACT

METAMORPHOSED MAFIC AND ULTRA-MAFIC INTRUSIVE ROCKS

5 — *5 Unsubdivided*; *5a Gabbro*; *5b Diorite*; *5c Amphibolite*; *5d Ultramafic rocks*; *5e Porphyritic gabbro*

INTRUSIVE CONTACT

METASEDIMENTS

CHEMICAL METASEDIMENTS#

4 — *4 Unsubdivided*; *4a Ironstone*; *4b Chert*

CLASTIC METASEDIMENTS#

3 — *3 Unsubdivided*; *3a Wacke*; *3b Arkrite*; *3c Arkose*; *3d Calc-silicate rock*; *3e Grit*; *3f Fine grained to very fine grained, graphitic meta-sediments and tuffs*; *3g Schist*; *3h Garnet-bearing*; *3i Biotite-bearing*; *3k Amphibole-bearing*; *3m Staurolite-bearing*

METAVOLCANICS

FELSIC TO INTERMEDIATE META-VOLCANICS#

2 — *2 Unsubdivided*; *2a Flow*; *2b Tuff*; *2c Lapilli-tuff*; *2d Pyroclastic breccia*; *2e Tuff-breccia*; *2f Porphyritic (feldspar phenocrysts)*; *2g Garnet-bearing*

MAFIC TO INTERMEDIATE META-VOLCANICS#

1 — *1 Unsubdivided*; *1a Flow*; *1b Tuff*; *1c Lapilli-breccia, pyroclastic breccia*; *1d Autoclastic breccia*; *1e Pillow lava*; *1f Amphibolite*; *1g Porphyritic (feldspar phenocrysts)*; *1j Garnet-bearing*; *1k Biotite-bearing*

Au	Gold
Be	Beryllium
Cu	Copper
Fe	Iron
Gr	Graphite
Li	Lithium
Ni	Nickel
po	Pyrrhotite
py	Pyrite

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

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

\# *Subdivision of major rock units does not indicate age relationship.*

\# *Age relationships between units 1, 2, 3 and 4 are unknown.*

The letter "G" preceding a rock unit number, indicates interpretation from geophysical data.

This compilation project is part of the Northern Ontario Geological Survey program and is funded by the Ontario Ministry of Northern Affairs.

PROPERTIES, MINERAL DEPOSITS

1. Amoco Canada Petroleum Company Ltd. [1976]
2. Amoco Canada Petroleum Company Ltd. [1976] (Sunday Lake Properties)
3. Amoco Canada Petroleum Company Limited. (Detour Lake Deposit)
4. Amoco Canada Petroleum Company Limited. (Detour Lake Deposit)
5. Asarco Explorations of Canada. (J.R. Mowat Option) [1966]
6. Asarco Explorations of Canada. (St. Laurent Deposit)
7. Canadian Javelin Limited. [1965]
8. Canadian Nickel Limited. [1971]
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11. Conwest Exploration Co. Ltd. [1958]
12. Conwest Exploration Co. Ltd. [1960]
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15. Dome Exploration (Canada) Limited. (Abbotsford Lake property)
16. Dome Exploration (Canada) Limited. (Tomlinson Properties)
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45. Triana Exploration Limited. (Kenning Prospect) [1957]
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Information current to Dec. 31st, 1978. Former properties on ground now open for staking are only shown where exploration data is available – a date in square brackets indicates last year of exploration activity. For further information consult report.

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Geology is not tied to surveyed lines.

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Magnetic declination in the area was approximately 11° west in 1978.

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