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Ontario Geological Survey

Report 209

Geology of the

Clontarf Area

Renfrew County

By

S.G. Themistocleous

1981

Ministry of Natural Resources

Ontario

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Ministry of Natural Resources

Hon. James A.C. Auld
Minister

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Deputy Minister

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1000-300-80-Sp

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(back pocket)

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, structure, and mineralization of parts of Grattan, Sebastopol and South Algona Townships, Renfrew County, an area of 262 km^2 located about 50 km south of Pembroke.

Most of the rocks in the area are of Late Precambrian age but Paleozoic limestone is also present. Outcrop is generally poor, less than 20 percent, due to the Pleistocene deposits of clay, sand and gravel.

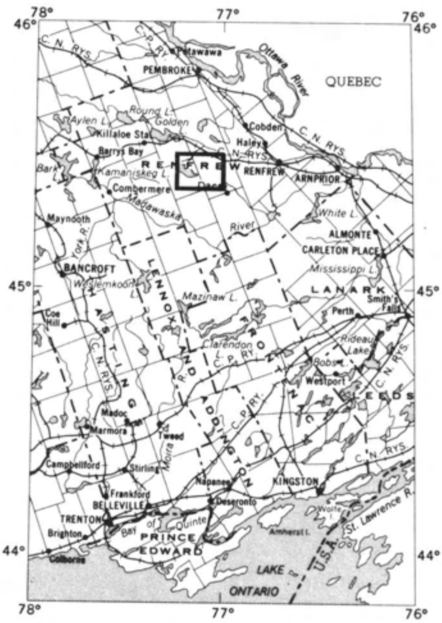


Figure 1–Key map showing location of the Clontarf area. Scale 1:3 168 000.

Metasediments and a variety of igneous rocks underlie most of the area. The oldest rocks are coarsely recrystallized metasediments: feldspathic arenite, wacke, quartzose arenite, biotite-hornblende-feldspar gneiss and marble. Large masses of quartz monzonite, syenite and gabbro intrude these rocks. Several outliers of Paleozoic, Ordovician limestone unconformably overlie the Precambrian rocks.

All the Precambrian rocks were complexly folded about north-trending axes. Fold plunges are generally southeast to south. The principal faults in the map-area belong to the Ottawa-Bonnechere Graben system, trending east to southeast. Mineral assemblages in the Precambrian rocks are indicative of upper almandine-amphibolite facies metamorphic conditions.

Economically interesting showings of feldspar, nepheline, gold, copper, molybdenum, uranium and rare earths are present. Interesting disseminated uranium mineralization showings were discovered during the 1977 field season associated with a "mixed" contact zone of quartz monzonite and pink feldspathic arenite. Some of these showings assayed as high as 0.68 percent U_3O_8.

Geology of the Clontarf Area

Renfrew County

by

S.G. Themistocleous[1]

INTRODUCTION

The Clontarf area is located in a region in which geological formations favourable to the occurrence of uranium mineralization were anticipated. The area had never been surveyed geologically other than in a reconnaissance fashion. A detailed survey of the area was recommended by the Ontario Geological Survey, Ministry of Natural Resources, as part of a larger program of resource evaluation and exploration stimulation in Renfrew County and received the support of the Ontario Ministry of Treasury and Economics and the Federal Department of Regional and Economic Expansion to carry it out. As indicated in the report interesting uranium mineralization occurrences were found by the survey party and a variety of other metallic and non-metallic occurrences are reported upon.

Location

The Clontarf map-area is located 30 km west of the town of Renfrew and 50 km south of the town of Pembroke; it is bounded by Latitudes 45°22'30''N and 45°30'N, and Longitudes 77°00'W and 77°15'W, encompasses approximately 272 km^2 and includes parts of Sebastopol, Grattan and South Algona Townships.

Access

In the late 1850s development of a colonization road, the Opeongo Road, running westward from Renfrew, reached the area and provided access to the

[1]Geologist, Precambrian Geology Section, Ontario Geological Survey, Toronto. Manuscript approved for publication by Chief Geologist, 26 June, 1978. This report is published with the permission of E.G. Pye, Director, Ontario Geological Survey.

area for settlers. At the present time road access to most of the area is good. Highway 41 runs approximately north-south across Grattan Township. From Eganville, Highway 512 trends west-southwest to Cormac and Foymount and passes through the northwest corner of the area. McGrath Road runs northward about 12 km from Clontarf to Highway 41. The extreme northeast corner of the map-area is traversed by a Canadian National Railway line. Several other township roads provide good access to most of the area. Lumbering operations are in progress in southern Sebastopol Township, southeast of Rileys Lake and northwest of Grassy Lake.

Prospecting and Mining Activity

The area was explored for phosphorous, iron, gold, molybdenum, feldspar, corundum, uranium, rare earths, and stone from 1878 to 1960 (Satterly 1945; Hewitt 1960). A number of apatite mines were active, on Turners Island, Lake Clear, and to the north of Lake Clear, Sebastopol Township, around 1880. An iron formation east of Highway 41, Grattan Township, was brought into production for iron in 1901 and operated till 1907. In Grattan Township a feldspar quarry operated in 1943 (Satterly 1945), and a limestone quarry operated intermittently from 1925 to 1960 (Satterly 1945; Hewitt 1960; Hewitt and Vos 1972).

Present Geological Survey

The present geological survey was carried out by the author and his assistants during the summer of 1977. Preliminary Map P.1560 was issued in 1978 (Themistocleous 1978). The base maps were prepared by the Cartography Section of the Lands and Waters Group from maps of the Forestry Resources Inventory. Field data were plotted on acetate overlays on vertical air photographs at the same scale as the base map. Outcrops were examined along lake shores, roads, and pace-and-compass traverse lines run at approximately right angles to strike of the formations. In a few places geological boundaries were traced directly in the field by walking along them. Outcrop locations were determined from pace-and-compass measurements, and tied into recognizable features on the base maps and air photographs. Traverses were spaced at 300 to 450 m intervals. Information from magnetic surveys and drilling (Gilbert 1951) has also been used in preparing the map.

Acknowledgments

This survey was done by the Ontario Geological Survey, Ministry of Natural Resources, as part of an exploration stimulation and resource evaluation program in the Renfrew County area with the support of the Ontario Ministry of Treasury and Economics and the Federal Department of Regional and Economic Expansion.

The author was assisted in the field by Craig Houle, Elford Williams, Murray Nunns, and C. McConnell. Mr. Houle as a senior assistant was responsible for part of the mapping.

Chemical and X-ray analyses, and mineral identification were done by the staff of the Geoscience Laboratories, Ontario Geological Survey. The author wishes to thank the exploration staff of The Algoma Steel Corporation Limited for providing the author with a detailed report on the former Radnor mine (Canada Iron Furnace mine). The author is indebted to Dr. S.B. Lumbers, Royal Ontario Museum, for an introduction to the geology of the area.

Previous Geological Work

Prior to the present study, no detailed mapping had been carried out in the map-area, but reconnaissance studies were made in parts of the area by: Murray (1857), Ells (1904), Parks (1928), Wilson (1936), Kay (1942), Hewitt (1954), Rose (1958), and Satterly (1945). Other references to the geology of the area are found in Kay's (1942) stratigraphic and structural study of the Ottawa-Bonnechere Graben and adjacent Madawaska Highlands.

The only known available geological maps of the area are: Map 53b of the Renfrew area which was based on compilation and reconnaissance examination (Satterly 1945), and Lumber's compilation maps of Renfrew County (1980).

Topography

The Clontarf area is one of topographic contrast with a large flat area to the north and rugged hilly terrain to the south. This is a reflection of block-faulting, related to the Ottawa-Bonnechere Graben system (Kay 1942).

The southwestern part of the map-area belongs to the Madawaska Highlands, a major structural and topographic unit (Kay 1942) which is bounded to the north by the Mount St. Patrick Fault. The Mount St. Patrick Fault is a normal fault, the north side of which is down thrown about 450 m (Kay 1942). Topographic elevations south of the Mount St. Patrick fault exceed 420 m. McDonalds Mountain south of Lake Clear, Sebastopol Township, has an elevation of over 420 m above sea level.

The Mount St. Patrick Fault lies on the south side of the Ottawa- Bonnechere Graben System, and the area north of the fault is characterized by large flat swampy areas. Elevations in the north part of the area increase toward the west, and this is a reflection of the type of bedrock. Sections underlain by carbonate metasediments have the lowest relief (200-230 m) whereas sections underlain by plutonic rocks have higher relief (250-300 m).

No major waterways pass through the area. Most of the 23 lakes in the area are quite small except for Lake Clear.

Natural Resources

The opening and development of this area is intimately associated with the development of the old colonization road, the Opeongo Road, in the period from 1850 to 1865; this was the beginning of settlement in the area. Several branching roads to the south of Opeongo Road helped to create settlements in this rugged area, but at the present time most of the farms to the south of Opeongo Road are abandoned due to the hilly, rocky topography and poor soil. To the north and adjacent to the Opeongo Road most of the farms are still in operation. Hay is the chief cultivated crop. Cattle are raised by most farmers in the area.

About 70 percent of the area is covered with white spruce, balsam, cedar, pine, birch, maple and hemlock. At the present time lumbering is a significant source of income for some of the residents in the area. The area south of Lake Clear and west and south of Rileys Lake is covered with mature white pine.

There are two tourist resorts on the west shore and several hundred cottages around the shores of Lake Clear. Lake Clear is well known for its trout, bass and pike fishing. Deer, fox, beaver, rabbit and wolves are common, black bears are rare.

GENERAL GEOLOGY

The bedrock formations underlying the area are of Precambrian and Paleozoic age. The Precambrian rocks consist largely of metasediments and plutonic rocks.

The central and eastern portion of the area is underlain by a succession of metasediments: feldspathic and quartzose arenites, quartzarenite, wacke, amphibole-rich gneiss, calc-silicate rocks, and marble, which have been intruded by gabbro, syenite, and quartz monzonite bodies, and diorite, diabase and pegmatite dikes.

The northwest corner of the map-area is underlain by granitic and syenitic rocks which have inclusions of carbonate and calcareous metasediments and are intruded by apatite-bearing pyroxenite dikes, granite pegmatite, syenite pegmatite, and nepheline syenite pegmatite dikes.

Within the metasedimentary belt the general metamorphic grade is upper almandine-amphibolite facies. These metasediments were subjected to regional tectonism that caused coarse metamorphic recrystallization, deformation, and conversion of these rocks to gneisses.

Several outliers of Ordovician limestone and fossiliferous shale unconformably overlie the Precambrian rocks on the southwest and northwest shores of Lake Clear, at Esmonde and in the northeast corner of the map-area.

Several major faults in the area represent part of the Ottawa-Bonnechere Graben system (Kay 1942) and trend east to southeast. Carbonatization, hematite staining, cataclastic microtextures, slickensides, and well developed shear zones are associated with these faults; present also are earlier north-northeast trending faults.

The bedrock formations are extensively overlain by glacial deposits and by Recent swamp accumulations.

TABLE 1 TABLE OF LITHOLOGIC UNITS FOR THE CLONTARF AREA.

CENOZOIC

QUATERNARY

PLEISTOCENE AND RECENT

Glacial and glaciofluvial deposits, swamp and stream deposits.

Unconformity

PALEOZOIC

ORDOVICIAN

Limestone, shale.

Unconformity

PRECAMBRIAN

LATE PRECAMBRIAN

UNMETAMORPHOSED PLUTONIC ROCKS

FELSIC AND ALKALIC INTRUSIVE ROCKS

Granite pegmatite and syenite pegmatite dikes.

MAFIC INTRUSIVE ROCKS

Diabase, diorite, hornblendite, pyroxenite dikes.

Intrusive Contact

METAMORPHOSED PLUTONIC ROCKS

FELSIC INTRUSIVE ROCKS

Albite quartz monzonite, xenolithic albite quartz monzonite.

ALKALIC INTRUSIVE ROCKS

Potassic syenite, hornblende-biotite syenite, hornblende-pyroxene syenite, nepheline syenite, nepheline syenite pegmatite dikes (porphyritic nepheline syenite).

MAFIC INTRUSIVE ROCKS

Quartz diorite, gabbro, porphyritic gabbro.

Intrusive Contact

METASEDIMENTS

CARBONATE METASEDIMENTS

Marble and siliceous marble; graphitic marble; calcareous siltstone.

CALCAREOUS METASEDIMENTS

Hornblende-quartz-plagioclase gneiss, diopside granofels, calc-silicate gneiss, hornblende-magnetite ironstone.

CLASTIC SILICEOUS METASEDIMENTS

Feldspathic arenite, quartzose arenite, wacke, quartzarenite, migmatitic biotite-quartz-feldspar gneiss.

Clontarf Area

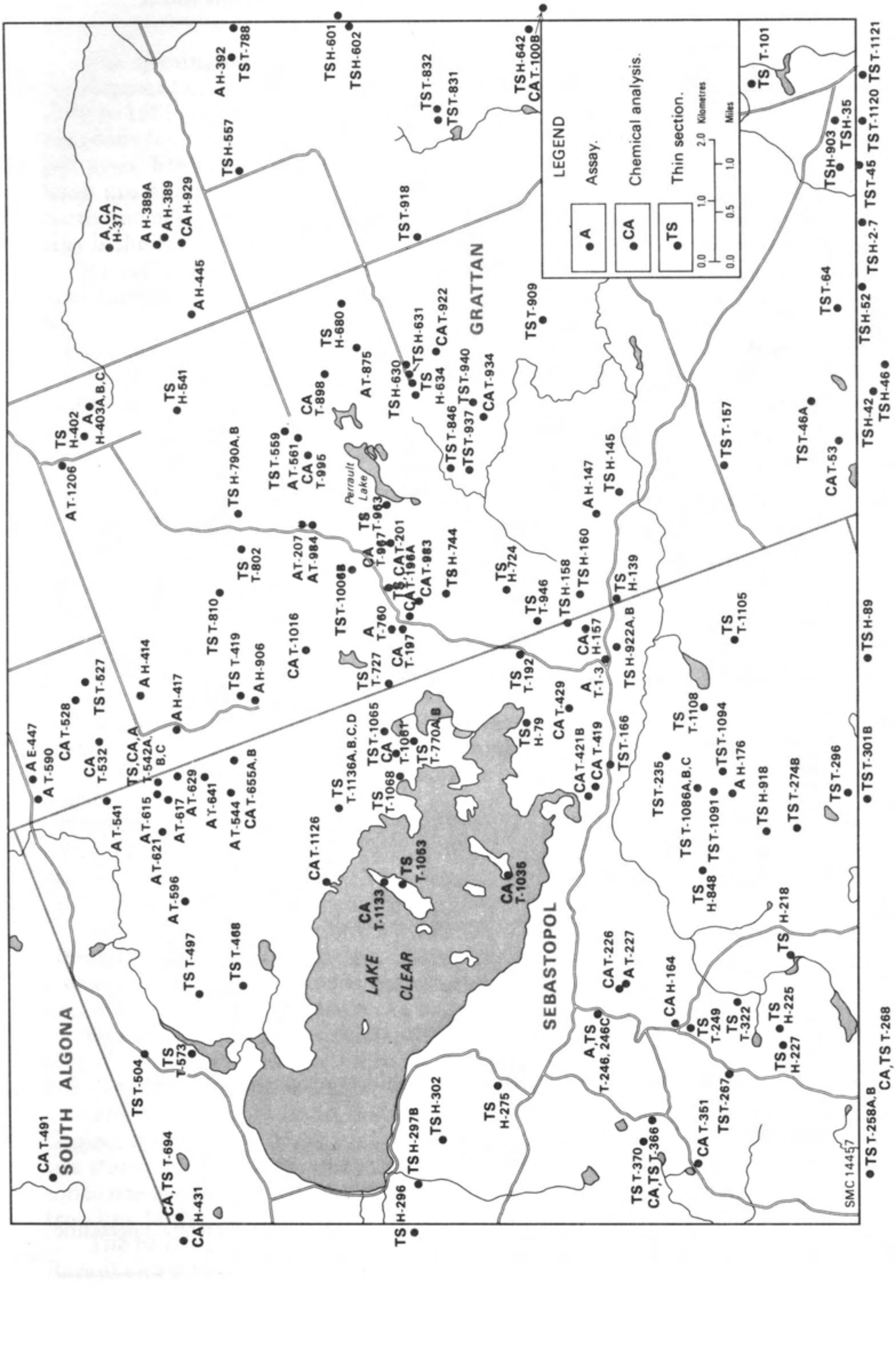


Figure 2–Location of samples taken for thin section, chemical analysis, or assay.

Late Precambrian

METASEDIMENTS

The metasediments underlie about two-thirds of the map-area, and four main groups are recognized (after Lumbers 1969).

Clastic siliceous metasediments characteristically contain up to 25 percent biotite and contain no carbonate. They are composed mainly of potassic feldspar, albite, quartz, biotite and garnet, and possess a granoblastic texture. These rocks can be grouped into two major units: 1) biotite-quartz-feldspar gneisses which may represent moderately to well sorted feldspathic and quartzitic arenite and quartzarenite, and 2) the biotite gneisses which probably represent poorly sorted wacke. The arenite greatly predominates over the wacke, but both facies are intercalated. These rocks have been metamorphosed to almandine-amphibolite metamorphic facies and are characterized by coarse grained porphyroblasts of garnet, feldspar and biotite.

The calcareous metasediments were derived from calcareous feldspathic wacke and from sandy limestone which contained a high proportion of clastic silicate minerals. These rocks have been metamorphosed to almandine-amphibolite facies and are characterized by decarbonatization and formation of abundant metamorphic amphibole (Lumbers 1968). The calcareous metasediments consist mainly of amphibole, feldspar, quartz, and variable amounts of biotite, pyroxene and carbonate material.

The iron formation was derived from calcareous chert with iron-rich layers. The iron formation has been metamorphosed to upper almandine-amphibolite facies and is characterized by coarse grained granoblastic magnetite, hornblende and minor diopside.

Carbonate metasediments which are derived from limestone and impure limestone, consist mainly of calcite (greater than 80 percent) and silicate minerals. The carbonate metasediments in the map-area have been metamorphosed to upper almandine-amphibolite facies and are characterized by coarse grained calcite (3 to 5 mm, but generally greater than 5 mm) (Hyndman 1972) and silicate minerals such as: diopside, plagioclase, scapolite, phlogopite and quartz. Dolomite is rare in the area. Tectonism in the areas of marble interbedded with thin (less than 1 m) clastic metasedimentary layers, resulted in the formation of abundant marble tectonic breccia due to brittle deformation of the incompetent layers and flow of the marble. The marble tectonic breccia is found throughout the area.

Clastic Siliceous Metasediments

In this part of the Grenville Province, the rocks have undergone dynamothermal metamorphism, metasomatism and granitization. The grade of metamorphism is high, the rocks have been altered and original structures and textures have been completely obliterated. The rocks as we now find them are a heterogenous metamorphic assemblage differing from their original character. Map-unit 1b, feldspathic arenite, was interpreted as sedimentary rock largely on the basis of field relations such as: (1) these rocks are bedded and interbanded with metawacke (unit 1g), quartzose arenite (unit 1c), and hornblende-quartz-plagioclase gneiss (unit 2a); (2) thin metawacke layers were traced over short distances within this unit with little or no signs of deformation or disturbance; (3) the structure (gneissosity) of the metawacke layers, quartzose arenite, hornblende-quartz-plagioclase gneiss does not show any discordance with the structures of the feldspathic arenite; and (4) the macro- and microtexture of these rocks is equigranular, subrounded to subangular with a few rounded grains of quartz possibly of sedimentary origin. However it should be emphasized that minor granitic veins within unit 1b trend subparallel to the regional gneissosity, and mineral foliation within these veins parallels the gneissosity. In places the feldspathic arenite has been granitized to such a degree that the original structures and textures have been completely obliterated. The distribution of these massive granitized feldspathic arenites is erratic and they are characterized by the general absence of late granite pegmatite veins or dikes.

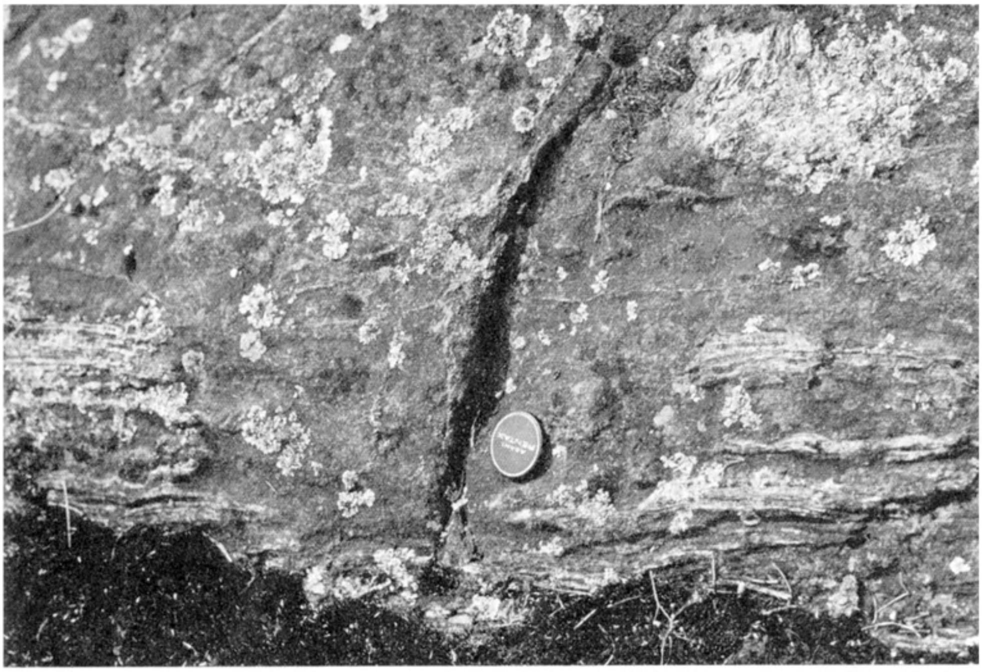
The meta-arenites underlie about a third of the map-area. In Sebastopol Township feldspathic arenite (map-unit 1b) underlies the area around Neumans, Trout, Little Trout, and Schavens Lakes, is intercalated with thin garnetiferous layers of biotite-quartz- feldspar gneiss (map-unit 1g), and is intruded by gabbroic and syenitic rocks. The feldspathic arenite in this location is very uniform in character with minor amounts of magnetite. In Grattan Township the arenite is intercalated with carbonate rocks, wacke, and amphibole-rich gneiss, and is intruded by albite quartz monzonite, granite pegmatite, gabbroic bodies, diabase dikes and diorite. The arenites have been metamorphosed to almandine-amphibolite facies and are characterized by the lack of matrix and primary structures. Macroscopically they exhibit a faint mineral foliation, and in a few places gneissic structure which comprises quartz rich layers intercalated with feldspar rich layers. Microscopically a granoblastic texture predominates with quartz elongation in a few cases. The feldspathic arenite (unit 1b) is characterized by less than 5 percent combined biotite and magnetite. Thin section examination indicates that these rocks also contain quartz (15-40 percent) and albite (5-20 percent). Grains are angular to subangular in shape and vary in size from 0.1 mm to 6 mm. These rocks are light pink in fresh and weathered surface and medium to coarse grained.

The biotite-quartz-feldspar gneiss or wacke (map-unit 1g) has been metamorphosed to upper almandine-amphibolite facies and is characterized by biotite content of between 8 and 25 percent. In thin section the rock consists of microcline or orthoclase (20-30 percent), twinned albite (10-20 percent), quartz (25-40 percent) and biotite (8-25 percent). Minor components which may also be present include garnet, apatite, hornblende, and opaque minerals. The biotite exhibits a preferred orientation either in clusters or in single crystals. The grain size varies from 0.2 mm to greater than 1 cm. Garnetiferous varieties are particularly abundant within this unit. These gneisses weather light grey and are dark grey in fresh surface. Gneissic to foliated structures are well developed and characterized by orientation of the mica. Thin layers and lenses consisting of feldspar and quartz are interlayered with biotite-rich layers producing the gneissosity; in other cases thin recrystallized clay layers intercalated with biotite-feldspar-quartz layers define the gneissosity. Garnetiferous units form distinct layers interbedded with the biotite-quartz-feldspar gneiss. The metamorphosed wackes are found in the vicinity of Plaunts Mountain, in lots 16, 17, concession IX, Sebastopol Township, in the area northwest of McGrath Road, Grattan Township, and also in the vicinity east of Highway 41, in lots 12 to 14, concessions X to XII and in lots 9 to 12, concession XII, Grattan Township. Within the last two areas disseminated coarse-grained magnetite is present in the biotite-quartz-feldspar gneiss, in amounts up to 15 percent of the rock. Several other metamorphosed wacke units are exposed south of Neumans Lake, Sebastopol Township.

Quartzose arenite (map-unit 1c) forms thin distinct layers interbedded with feldspathic arenite, weathers light grey, and is white to grey in fresh surface. In thin section the quartzose arenite was observed to consist of quartz (30-40 percent), microcline-orthoclase (20-30 percent) and albite (20-30 percent). Minor biotite (5-10 percent), hornblende, diopside and, in one location, muscovite (less than 1 percent) are present. The texture is granoblastic, and coarse grained, with subangular to subrounded quartz and feldspar grains. The quartzose arenite has been metamorphosed to almandine-amphibolite facies, and is characterized by the absence of primary structures and matrix. Thin layers of quartzose arenite are found to grade into the feldspathic arenite and occur north of Woermke, northeast of Neumans Lake and east of Perrault Lake.

Massive to gneissic, medium to coarse grained, white weathering quartzarenite (map-unit 1e) is found in the map-area as thin layers or nests intercalated within marble, arenite, and in one location within pyroxene-rich rock (Photo 1). The thickness of the quartzite units does not exceed 3 m. This rock type is found northwest of Duffys Lake, Grattan Township, northwest of Meadow Lake in lot 34, concession XI and XII, Sebastopol Township, and in several other locations. The quartzarenite occurs as massive, coarsely crystalline layers, and as thin gneissic medium-grained layers. A gneissic rock consisting of quartzarenite layers interbedded with very thin quartz-pyroxene layers occurs in lot 34, concession XI, Sebastopol Township, associated with pyroxene hornfels rocks. A thin section of the gneissic quartzarenite indicates that it consists predominantly of feldspar (5-25 percent) and quartz (55-75 percent). Minor components include diopside and hornblende. The rock is medium grained with most of the quartz grains having ribbon or elongated shape.

Table 2 lists chemical analyses of feldspathic arenite, wacke and quartzose arenite. The wacke is characterized by less than 62 percent SiO_2, 1.0 percent TiO_2 and greater than 8 percent Fe_2O_3 + FeO, the quartzose arenite is characterized by 64 to 67 percent SiO_2, 0.60 to 0.90 TiO_2 and between 7 to 8 percent Fe_2O_3 + FeO, and the feldspathic arenite is characterized by more than 68 percent SiO_2, less than 0.50 percent TiO_2 and less than 6.0 percent Fe_2O_3 and FeO combined. Location of samples is given in Figure 2.



OGS 10 229

Photo 1–Quartzite remnants in pyroxene granofels, approximately 3 km north of Hardwood Bay, Lake Clear.

Calcareous Metasediments

The calcareous metasediments comprise amphibole-rich gneisses (map-unit 2) which are interbedded with clastic siliceous and carbonate metasediments and probably represent rock facies intermediate in composition between these. These rocks have been metamorphosed to almandine-amphibolite metamorphic facies and are characterized by abundant coarse-grained amphibole. In thin section the layered amphibole-quartz-plagioclase gneiss (map unit 2a) was observed to consist of albite + orthoclase + microcline + hornblende + quartz. Other phases include: diopside, biotite, garnet, apatite, scapolite, sphene and opaque minerals. These rocks possess a granular texture and appear massive in thin section. Their grain size varies from 0.2 mm to 5 mm. The plagioclase is almost completely converted to sericite. The amphibole-rich gneisses weather dark grey to green and are gneissic with thin mafic-rich layers intercalated with feldspar-hornblende layers. These rocks are intercalated with arenites (map-unit 1) and marbles (map-unit 3) and locally contain ironstone (see Economic Geology). Distinct units of amphibole-rich gneiss are more abundant east of Newfoundout but thin units are present elsewhere. Lenses

TABLE 2 CHEMICAL ANALYSES IN WEIGHT PERCENT OF CLASTIC SILICEOUS METASEDIMENTS. ANALYSES BY GEOSCIENCE LABORATORIES, ONTARIO GEOLOGICAL SURVEY.

	T-201	T-934	T-100B	H-929	T-1133	T-922	T-268	T-1016
SiO_2	64.3	66.6	68.2	75.1	70.2	58.5	59.2	61.9
Al_2O_3	13.4	14.8	14.1	14.2	15.7	18.5	18.3	16.9
Fe_2O_3	3.25	7.66*	5.24*	0.27*	3.08*	10.1*	10.7*	8.82*
FeO	4.16							
MgO	2.41	1.45	1.04	0.14	0.37	2.84	4.17	3.74
CaO	4.09	2.79	2.70	0.29	0.94	1.65	2.54	2.10
Na_2O	4.25	5.09	5.85	3.66	3.78	3.78	1.48	2.86
K_2O	1.27	0.66	2.76	5.53	4.59	3.73	3.23	2.58
H_2O^+	0.49	0.12	–	ND	0.17	0.26	0.69	0.47
H_2O^-	0.19	0.33	0.35	0.34	0.33	0.35	0.21	0.37
CO_2	0.48	0.11	0.10	0.08	0.09	0.10	0.13	0.16
TiO_2	0.85	0.65	0.43	0.01	0.30	1.21	1.13	1.06
P_2O_5	0.06	0.19	0.11	0.04	0.08	0.14	0.16	0.17
S	0.32	0.01	0.01	ND	ND	0.01	ND	0.01
MnO	0.26	0.16	0.09	0.01	0.02	0.10	0.09	0.15
Totals	99.8	100.4	100.7	99.6	99.6	100.6	101.7	100.6
S.G.	2.80							

* Fe_2O_3 and FeO are combined.

SAMPLES (for locations, see Figure 2).

T-201 – Garnet-biotite-feldspar-quartz gneiss (wacke). Map-unit 1g.

T-934 – Magnetite-biotite-quartz-feldspar gneiss (feldspathic arenite). Map-unit 1b.

T-100B – Pink gneissic feldspathic arenite. Map-unit 1b.

H-929 – Biotite-magnetite-feldspar-quartz gneiss (feldspathic arenite). Map-unit 1a.

T-1133 – Feldspathic arenite with biotite-k-feldspar rich layers. Map-unit 1b.

T-922 – Garnet-biotite-quartz-feldspar gneiss (wache).

T-268 – Garnet-biotite-quartz-feldspar gneiss (wacke).

T-1016 – Garnet-biotite-quartz-feldspar gneiss (wacke).

and xenoliths of this unit occur within the albite quartz monzonite in lots 33 and 34, concessions XI and XII, Sebastopol Township.

Pyroxene-rich rock (unit 2c) is exposed in a few places as small irregular masses (see Photo 1). These occurrences are commonly less than 10 m thick and normally occur in association with marble or along its contact with intrusive rocks. The pyroxene hornfels consists mainly of granular, coarse-grained, pale green to green diopside. Mica concentrations and gneissic quartzarenite are usually found within the pyroxene-rich hornfels (see Photo 1). This rock type was believed by Wilson (1924) to have been formed from limestone, by the action of siliceous emanations from igneous intrusions. Several other possibilities with respect to its origin are: (1) limy mudstone which was metamorphosed to upper almandine-amphibolite facies and metasomatized; or (2) argillite with

TABLE 3 CHEMICAL ANALYSES IN WEIGHT PERCENT OF CALCAREOUS METASEDIMENTS. ANALYSES BY GEOSCIENCE LABORATORIES, ONTARIO GEOLOGICAL SURVEY.

	T-196A	T-366	T-53	T-351	T-983	T-995	T-1035	T-655A	T-655B
SiO_2	48.5	48.8	47.0	53.8	45.9	50.1	48.7	65.1	56.3
Al_2O_3	11.8	15.4	17.9	17.3	15.2	20.6	17.3	3.46	3.53
Fe_2O_3	3.42	6.03	10.2*	11.2*	11.0*	8.33*	11.3*	3.18*	4.90*
FeO	3.79	6.90							
MgO	8.45	4.50	8.46	5.70	7.55	4.39	6.90	15.7	14.0
CaO	15.7	9.50	9.52	3.22	9.45	8.04	8.70	7.56	18.2
Na_2O	3.30	5.17	4.62	3.85	1.77	5.18	4.23	1.73	1.33
K_2O	0.50	0.59	0.70	3.09	5.17	1.52	1.74	1.69	1.51
H_2O^+	0.80	0.25	0.50	0.97	0.99	0.47	1.03	0.06	0.17
H_2O^-	0.20	0.17	0.35	0.36	0.41	0.38	0.32	0.33	0.36
CO_2	0.22	0.23	0.14	0.38	0.16	0.14	0.14	0.10	0.09
TiO_2	0.68	1.32	1.15	1.31	1.41	1.26	0.79	0.15	0.13
P_2O_5	0.14	0.18	0.16	0.13	0.61	0.32	0.18	0.05	0.16
S	1.26	0.29	0.06	0.03	0.18	0.30	0.16	ND	ND
MnO	0.12	0.23	0.15	0.09	0.14	0.10	0.18	0.11	0.21
Totals	98.9	99.6	100.6	101.1	99.3	100.6	101.0	99.4	100.8
S.G.	3.01	3.0							

* Fe_2O_3 and FeO are combined.

SAMPLES (For locations, see Figure 2).

T-196A — Biotite ± magnetite + hornblende + feldspar gneiss, layers in marble.
T-366 — Biotite ± magnetite + hornblende + feldspar gneiss, northwest of Woermke.
T-53 — Hornblende-feldspar gneiss.
T-351 — Biotite-hornblende-feldspar gneiss.
T-983 — Diopside ± biotite + hornblende + feldspar gneiss.
T-995 — Hornblende-feldspar gneiss.
T-1035 — Biotite-hornblende-feldspar gneiss, Turners Island, Lake Clear.
T-655A — Quartzite.
T-655B — Pyroxene hornfels (diopside ± quartz).

intercalated siliceous cherty layers were metamorphosed under low pressure, high temperature metamorphic conditions to pyroxene-rich rock and quartzite, after which metasomatism altered some of the thin quartzite layers to pyroxene-rich rock with disseminated quartz.

The analyses of amphibole-rich gneisses listed in Table 3 generally show a higher content of Fe_2O_3 + FeO, CaO, MgO, and TiO_2, than the clastic siliceous metasediments (see Table 2) and lower K_2O, and Na_2O. A comparison of this data with a calcareous metasediment in the Limerick and Tudor Townships area (Lumbers 1969, sample 2, Table 5) shows some similarity, particularly sample T-196A, but in general rocks in the map-area are higher in Al_2O_3, FeO + Fe_2O_3, MgO and Na_2O + K_2O and lower in CaO and CO_2.

OGS 10 230

Photo 2–Marble showing contorted gneissosity defined by mica concentrations, approximately 1 km west of Newfoundout.

Carbonate Metasediments

The carbonate metasediments of the map-area consist of coarse-grained phlogopitic, diopsidic, and graphitic marbles. The colour of these rocks varies from white to pink to grey. These marbles are more abundant in the central to southeast portion of the map-area. The metasediments are intruded by diabase and syenite and granite pegmatite dikes, and by syenite, quartz monzonite and gabbro bodies and are intercalated with the clastic siliceous and calcareous metasediments.

Gneissosity is rare and foliation where present is difficult to determine. Gneissosity is marked by: (1) alternating pink and white layers (east of Connor Lake, Grattan Township); (2) concentrations of aligned biotite-phlogopite in thin layers, less than 1 cm in width (Photo 2); (3) alignment of coarse-grained graphite; and (4) interbeds of feldspathic arenite and pyritic calcareous quartzarenite. On weathered surfaces the silicate mineral interbeds stand up in relief. The interbeds of the feldspathic arenite and wacke are generally folded and complexly crumpled, often forming overall rounded nests of calcareous composition, and quartzofeldspathic masses of irregular shapes. Calcareous quartzarenite with massive pyritiferous areas interbedded with the carbonate rocks are believed by the author to have been originally ferruginous calcareous siltstones.

OGS 10 231

Photo 3–Scapolite skarn southwest of Constant Lake. Note the fibrous white scapolite, which is faintly radioactive.

In thin section the marbles are seen to consist mainly of calcite (greater than 70 percent). Other phases include coarsely crystalline porphyroblasts of diopside, apatite, scapolite, biotite, quartz, microcline, microperthite, graphite and amphibole. Most of the accessory minerals have subhedral to euhedral shapes and, where deformed, exhibit ovoidal to rounded shape. The grain size of the calcite varies from 0.3 mm to 8 mm and the texture is idiotopic.

Dolomitic marble (map unit 3d) is scarce in the map-area, found only west of McGrath Road, north of the Sebastopol Township dump (lot 33, concession V), as a massive, medium grained dolomitic marble, which has layers of rusty quartzose arenite, and deeply weathered friable marble tectonic breccia. Scapolite skarns, called felsic tactites by Lumbers (1969), occur as distinct pods and patches, in and close to the contact of marble with granitic and syenitic rocks. They are coarse grained with fibrous, columnar, and very often radiating crystals and aggregates of white scapolite (Photo 3) in pyroxene-amphibole matrix. Other phases present are albite, biotite, carbonate, sphene and apatite. These bodies are considered to be metasomatised carbonate metasediments (Lumbers 1969) found in the metamorphic aureoles of intrusive bodies. Scapolite skarns were found on Highway 512, northwest of Little Lake Clear, Sebastopol Township, within a marble unit, on the western flank of McDonalds

OGS 10 232

Photo 4–Pyroxene skarn, 0.3 km south of Opeongo Road, on the road leading to Schaven Lake.

Mountain, Sebastopol Township, within a syenite body on a road leading from Highway 41 to Constant Lake (see Photo 6) and in several other locations.

Pyroxene skarns (Photo 4), called mafic tactites by Lumbers (1969), are characterized by more than 50 percent coarsely crystalline, light green diopside. Other phases include carbonates, plagioclase, scapolite, and amphibole. They are massive and are less than 3 m in diameter. A pyroxene skarn occurs approximately 0.3 km south of the Opeongo Road, on the road leading to Schavens Lake.

METAMORPHOSED PLUTONIC ROCKS

Mafic Intrusive Rocks

A series of mafic intrusions, consisting of gabbro, and quartz diorite occur throughout the area. The biggest mafic bodies are the Woermke metagabbro and the Clontarf quartz diorite. Several smaller bodies which are generally less than 0.2 km in width also occur. The smaller mafic bodies can be separated into two groups on the basis of their mineralogy and structure: (1) scapolite + hornblende + diopside hornfels and gneiss and (2) biotite + quartz + magnetite + hornblende + pyroxene + plagioclase hornfels.

The scapolitic gneisses occur north-northeast of Meadow Lake as thin extensive sheets (0.1 by 2-3.4 km long) striking subparallel to the gneissosity of the metasediments. These rocks weather dark green with white spots, are coarse grained and completely recrystallized into amphibole, pyroxene and white scapolite. In thin section these rocks are seen to have a granoblastic texture and consist of varying proportions of scapolite + hornblende + diopside. Sphene occurs as an accessory mineral.

The biotitic hornfels is coarse-grained metagabbro and occurs southwest of Perrault Lake and on Highway 41. These rocks weather grey to dark green, are porphyritic with some amphiboles exceeding 25 mm in the long dimension, set in a coarse-grained interlocking matrix of plagioclase, pyroxene and amphibole. They are massive, coarse grained and these and the metagabbro of Highway 41 are locally brecciated.

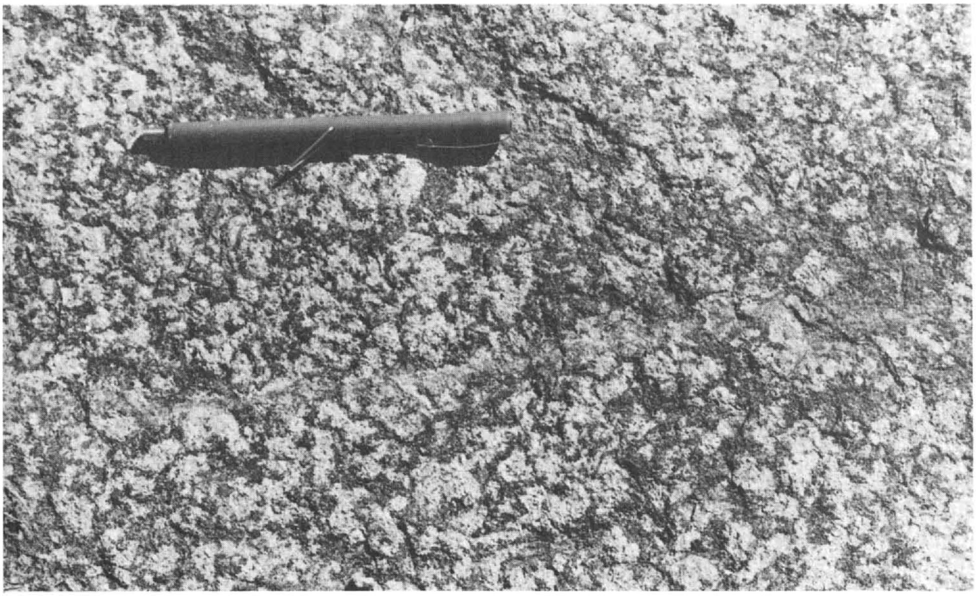
WOERMKE METAGABBRO

The largest mafic intrusive body is the Woermke metagabbro, the main mass of which forms a lenticular body 7 km long by 1 km wide trending along the western flank of McDonalds Mountain to Opeongo Road where it is offset by the Mount St. Patrick Fault eastwards about 2 km. The continuation of this unit is exposed on either side of Opeongo Road, about 1.7 km westwards from Clontarf. This body is medium to coarse grained, massive, and consists of "triangular" interconnected aggregates of pyroxene, amphibole and minor biotite, in a groundmass of plagioclase. The grain size varies from 0.2 mm to 15 mm. This gabbro body possesses a granular texture (Photo 5), weathers white to light grey, with dark green interconnected aggregates, and is dark green to yellowish grey on fresh surface. Several late small mafic (diorite) and felsic (granite pegmatite) dikes cut this body. This gabbro has a high sodium and potassium content (samples T-226, H-164, Table 4) compared to Nockolds (1954) average gabbro. In a few areas sulphide mineralization was observed (see Economic Geology).

CLONTARF QUARTZ DIORITE

Quartz diorite forms a sheet or lens striking subparallel to the sedimentary gneissosity, approximately 0.2 km east of Clontarf. It has a length of about 2.5 km and a maximum width of 0.7 km. The quartz diorite weathers dark grey and is medium to coarse grained. This body intrudes feldspathic arenite and quartzose arenite and includes lenses and xenoliths of quartzose arenite in several places. The quartz diorite is intruded by granite pegmatite dikes and possesses a weak gneissic structure defined by thin amphibole rich layers in a foliated biotite + amphibole + feldspar groundmass.

In thin section the quartz diorite is seen to consist of varying proportions of the following minerals: albite (generally showing sericitization) + orthoclase



OGS 10 233

Photo 5–Massive, medium grained, Woermke metagabbro, approximately 1.3 km north of Neumans Lake.

+ quartz + amphibole. Accessories include: apatite, diopside, sphene, and magnetite. Biotite is generally dominant over amphibole, and plagioclase is present in variable amounts. Biotite and sodic amphibole average about 20 percent and are set as interstitial minerals in a coarse-grained, granoblastic intergrowth of quartz and feldspar.

Chemical analyses of the quartz diorite are given in Table 4.

Alkalic Intrusive Rocks

There are several types of alkalic intrusive rock within the map-area which have been grouped with respect to composition and structure:

1) Pyroxene-amphibole pink massive syenite (map-unit 5c);
2) Gneissic, amphibole-rich syenite (map-unit 5b);
3) Leucocratic syenite (less than 6 percent mafic minerals) (map-unit 5a);
4) Lineated amphibole-biotite syenite (map-unit 5f);
5) Nepheline syenite (map-units 5d and 5e).

PYROXENE-AMPHIBOLE SYENITE

A body of pyroxene-amphibole syenite (map-unit 5c) covers an area of approximately 18 km^2 in the northwestern corner of the map-area and extends

TABLE 4 | CHEMICAL ANALYSES IN WEIGHT PERCENT OF MAFIC INTRUSIVE ROCKS. ANALYSES BY GEOSCIENCE LABORATORIES, ONTARIO GEOLOGICAL SURVEY.

	H-157	T-197	H-164	T-226	T-898	T-967	T-1061
SiO_2	58.1	53.2	47.0	50.2	51.4	45.7	47.9
Al_2O_3	19.1	2.4	17.7	23.9	15.8	21.0	18.2
Fe_2O_3*	5.52	6.10	11.7	7.25	9.72	10.4	11.7
MgO	3.67	14.3	4.08	2.18	7.81	5.54	5.47
CaO	6.02	21.9	8.17	7.81	9.51	9.54	8.39
Na_2O	5.28	0.86	4.54	4.81	3.82	3.56	4.15
K_2O	1.68	0.22	1.53	1.46	0.66	1.68	1.79
H_2O^+	0.54	0.09	0.71	0.51	0.41	1.00	0.52
H_2O^-	0.35	0.30	0.32	0.36	0.34	0.35	0.31
CO_2	0.20	0.40	0.24	0.22	0.20	0.16	0.16
TiO_2	0.62	0.09	1.98	1.14	0.66	0.99	1.54
P_2O_5	0.13	0.47	1.20	0.18	0.16	0.19	0.21
S	0.01	–	0.18	0.05	0.01	0.05	0.09
MnO	0.09	0.24	0.13	0.07	0.07	0.13	0.07
Totals	100.9	100.7	98.8	99.6	100.0	99.8	100.1

*Fe_2O_3 and FeO are combined.

SAMPLES (For locations, see Figure 2).

H-157 – Quartz Diorite, (Map-unit 4a), east of Clontarf.
T-197 – Pyroxenite (Map-unit 7b), McGrath Road.
H-164 – Gabbro (Map-unit 4e),Woermke.
T-226 – Gabbro (Map-unit 4e), McDonalds Mountain.
T-898 – Quartz Diorite (Map-unit 4a), east of Perrault Lake.
T-967 – Coarse grained porphyritic gabbro (Map-unit 4e), west of Perrault Lake.
T-1061 – Massive Gabbro (Map-unit 4e), northwest of Meadow Lake.

westwards to Brudenell Township. This syenite is pink to brownish pink on fresh and weathered surface, coarse grained, and massive to gneissic. The grain size varies from 2 mm to 25 mm. The gneissosity is defined by alternating hornblende- and/or pyroxene-rich, and feldspar-rich layers. The gneissosity is observed in a very few places, usually along cliffs, because of the characteristic shallow dip. No preferred orientation of minerals has been observed. Apatite-bearing pyroxenite dikes up to 60 cm wide, and granite and syenite pegmatite dikes up to 2 m wide crosscut the gneissosity of the syenite. Nepheline-bearing syenite pegmatite dikes also cut the pyroxene-amphibole syenite. The syenite contains xenoliths of amphibole-plagioclase gneiss, and calcite veins which are usually apatite-bearing. This rock consists of three distinct phases with respect to mafic content: (1) pyroxene phase, (2) amphibole phase, and (3) leucocratic phase which has less than 1 percent mafic minerals. Very commonly all three phases are present in one outcrop, with the first two containing less than 10 percent mafics. These rocks are composed of microcline and orthoclase (50-70

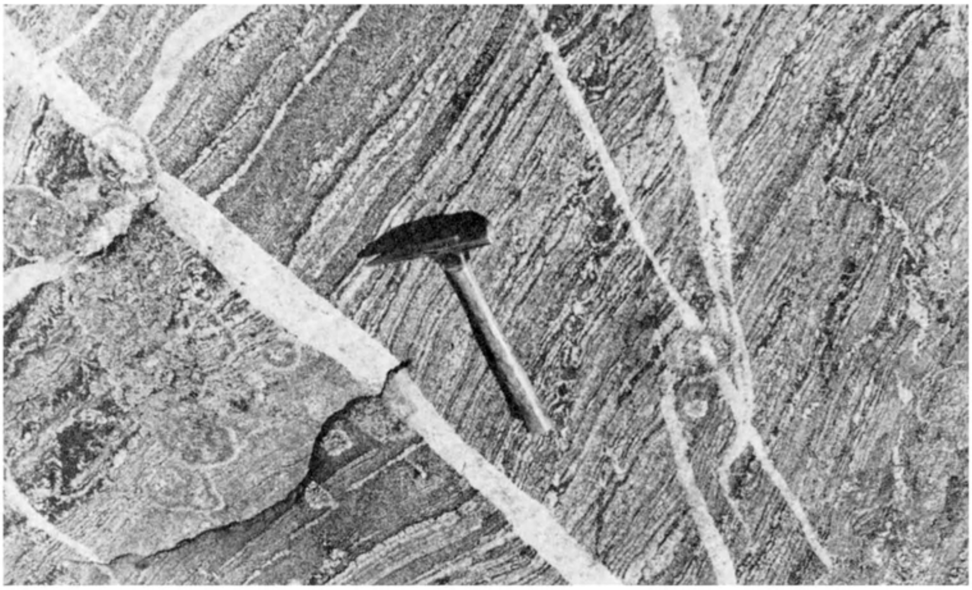

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Photo 6–Gneissic syenite intruded by thin granite pegmatite, approximately 0.5 km east of the Grattan-Sebastopol Townships boundary.

percent), albite (20-25 percent), diopside (1-10 percent), and hornblende (1-10 percent). The leucocratic phase usually is coarser grained, having a pegmatitic appearance.

GNEISSIC HORNBLENDE-BIOTITE SYENITE

A folded gneissic amphibole syenite sheet (unit 5b) underlies part of the northwest corner of Grattan Township, south of Highway 512, and east of the Sebastopol-Grattan Townships boundary. This folded sheet is 0.7 km to 0.4 km in thickness. The syenite is medium to coarse grained and has a gneissic structure. The gneissosity is defined by alternating, thin amphibole-rich layers and thick feldspar-rich layers (Photo 6). This rock weathers light pink to dark green and has no preferred mineral orientation. In places the gneissic syenite shows sulphide oxidation and minor pyrite-chalcopyrite disseminations. Diorite, pyroxenite, hornblendite, and granite pegmatite dikes with well defined boundaries cross-cut the gneissosity (Photo 6). The contact of the gneissic syenite with the feldspathic arenites is a gradational one, with the syenite close to the contact having variable amounts of quartz, up to 15 percent and the arenite containing clusters of amphibole which have the appearance of inclusions. Syenite pegmatite dikes up to 40 cm in width are present also in the feldspathic arenite and are more abundant in the contact zone.

In thin section the gneissic syenite was seen to consist of 50-65 percent sodic plagioclase (albite), which shows antiperthitic texture, 20-25 percent microcline with perthitic texture, 5-10 percent hornblende and riebeckite and 1 percent biotite. Other phases include sphene, magnetite, iron oxides, apatite, and quartz. These rocks show a coarse grained granoblastic texture.

LEUCOCRATIC SYENITE

Leucocratic syenite (map-unit 5a) occurs as small nests and patches within the metasedimentary belt. The rock is coarse grained, weathers grey to yellowish pink, and is massive, with a sandy texture. In most outcrops the rock is leucocratic but in a few places sodic amphibole (riebeckite) and biotite are present. In thin section these rocks are seen to consist of variable amounts of sodic plagioclase (albite) (10-80 percent), which shows antiperthitic texture and is usually sericitized, 10-60 percent microcline showing perthitic texture (rods, strings, patches, blobs) and orthoclase, 0-20 percent riebeckite, and 0-5 percent biotite. Other phases include sphene, quartz, apatite, scapolite, diopside, muscovite, sericite, iron oxides and magnetite. They possess a granoblastic texture with curved and embayed grain boundaries.

LINEATED AMPHIBOLE-BIOTITE SYENITE

Lineated amphibole-biotite syenite (map-unit 5f) is exposed along the southeast shore of Lake Clear, on the Opeongo Road west of Clontarf and over an area 5 by 2.5 km, west from McDonalds Mountain. It weathers light pink to light grey pink, and is massive with clots of amphibole-biotite forming a shallow plunging lineation to the southeast. Cataclastic structure and joints subparallel to the Mount St. Patrick Fault are sometimes present. This body is characterized by the presence of xenoliths of metagabbro, schlieren of marble tectonic breccia, calcite veinlets along joint planes, scapolite skarns and calcite patches with massive pyrite stringers.

The lineated syenite is mainly composed of 50-60 percent sodic plagioclase (albite), 30-40 percent microcline-orthoclase, 0-10 percent biotite, 0-3 percent hornblende, and minor magnetite and quartz. Other phases include sphene, carbonate, diopside, scapolite, and apatite. These rocks are coarse grained and the grain size varies from 0.2 to 10 mm.

NEPHELINE SYENITE

The nepheline syenites of the map-area are grouped into two distinct types: (l) gneissic grey-white nepheline syenite (map-unit 5d), and (2) pegmatitic nepheline syenite (map-unit 5e). The gneissic nepheline syenite is coarse grained, foliated with elongated nepheline crystals in a granular feldspar, magnetite, and biotite groundmass. A sheet of this gneissic nepheline syenite approximately 20 m thick occurs approximately 2.2 km south of Mud Lake and 1.8 km west of Rileys Lake within a sequence of gneissic amphibole syenite and marble layers. It is underlain by layers of gneissic to weakly gneissic syenite and thick marble layers, and overlain by gneissic syenite, marble layers, calc-silicate gneiss and gneissic syenite. It weathers light greyish with deeply weathered milky nepheline. This body resembles the nepheline gneisses of the Wolfe nepheline gneiss belt (Hewitt 1954, 1961; Appleyard 1967). The sedimentary (Appleyard 1967) or igneous (Hewitt 1954, 1961) derivation of this body cannot be established here because of the poor exposure in the area, but the following features seem to support the sedimentary origin of the nepheline syenite body: (1) absence of any cross-cutting or discordant relationship between the formations, (2) the internal structure of this unit resembles supracrustal layering, and (3) all the lithological units in the vicinity with the exception of the lineated syenite and pegmatites possess internal banding. Several of these units are of undoubted sedimentary origin such as marble layers, quartzose arenite, and calc-silicate gneiss.

In thin section this rock is seen to consist mainly of nepheline showing minor sericitization, plagioclase (albite to oligoclase), microcline, biotite, and magnetite. Carbonate minerals (calcite) are also present. It has a granular texture with variable grain size, varying from 0.2 to 30 mm.

The porphyritic nepheline syenite (map unit 5e) pegmatites are exposed in the northwest corner of the map-area. Several late nepheline syenite pegmatite dikes and patches parallel and cross-cut the weakly gneissic potassic pyroxene-hornblende syenite within a 300-450 m wide and 3 km long zone (see Figure 6) in lots 17 to 19, concession I, South Algona Township and in lots 13 to 16, concession XIV, Sebastopol Township. An average of 25-30 percent pegmatitic nepheline syenite occurs within this zone. The nepheline syenite pegmatite is coarse grained, with deeply weathered milky nepheline crystals imbedded in a granular, white groundmass of feldspar, magnetite, and biotite (Photo 7). In most places the nepheline has been stained by iron oxides to a light grey-black colour. The grain size of the nepheline varies from 2 mm to 12 cm and the grain size of the groundmass from 0.1 mm to 25 mm. Also present as alteration products of nepheline are minor sodalite in blue patches and euhedral hydronephelite which is purple on fresh surface.

A thin section from a hydronephelite-bearing syenite pegmatite is seen to consist of plagioclase, hydronephelite, biotite, magnetite, and carbonate material. Other phases include apatite.

Table 5 shows the variation in chemical composition of the syenite rocks. The nepheline syenite pegmatite is low in TiO_2, MnO, moderately low in Fe_2O_3 + FeO, compared to Nockolds' average nepheline syenite (1954). The pyroxene syenite (T-491) compares to a calc-alkalic syenite, the leucocratic syenite (T-429) compares to an average alkalic syenite, and the lineated syenite (T-419) compares to a sodic alkalic syenite, of Nockolds (1954).

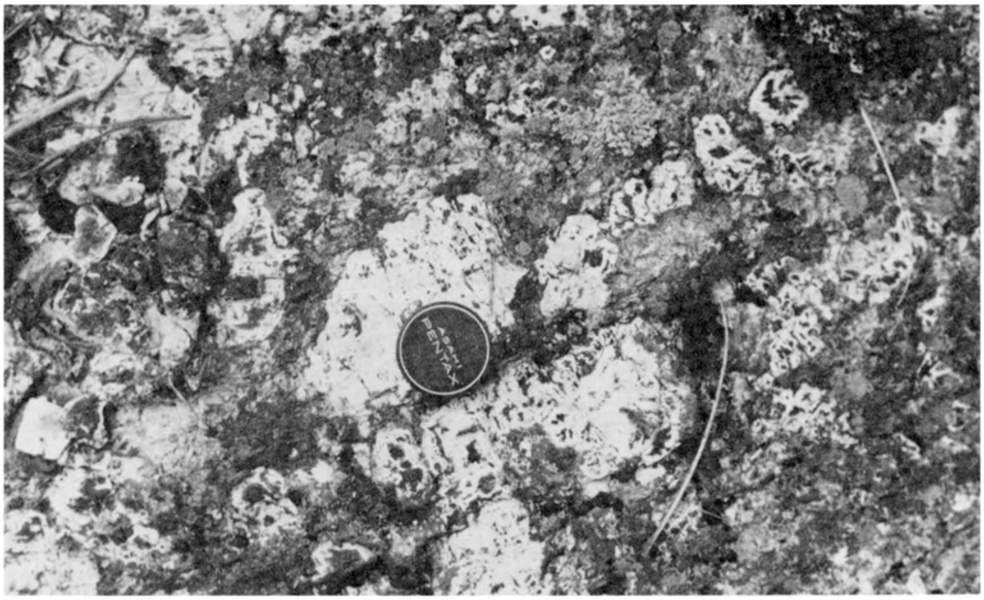

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Photo 7–Nepheline syenite pegmatite from the South Algona-Sebastopol Townships nepheline syenite zone. The nepheline is creamy white with black stains, the albite is grey.

Felsic Intrusive Rocks

Late Precambrian granitic rocks underlie part of central and northern Sebastopol Township and parts of western and northern Grattan Township. They are considered to be part of the same intrusive event. The composition and texture of these rocks is relatively uniform. The margins of these granitic stocks are characterized by assimilation, migmatization and contact metamorphism.

The two biggest granitic masses of the Clontarf map-area are (1) Basils Lake albite quartz monzonite and (2) Little Lake Clear albite quartz monzonite. It is possible that the Basils Lake and Little Lake Clear masses are part of one large intrusion, perhaps at slightly different erosion levels separated by a down faulted slice of Paleozoic limestone and Precambrian metasediments between the Mount St. Patrick and Shamrock Faults. Other smaller granitic bodies are also present in the map-area, e.g. in lots 19 to 22, concessions XV and XVI, Grattan Township.

BASILS LAKE STOCK (ALBITE QUARTZ MONZONITE)

This body covers an area approximately 5 km long by 4 km wide and has several inclusions of wacke, syenite and calcite veins. The albite quartz mon-

TABLE 5 | CHEMICAL ANALYSES IN WEIGHT PERCENT OF ALKALIC INTRUSIVE ROCKS. ANALYSES BY GEOSCIENCE LABORATORIES, ONTARIO GEOLOGICAL SURVEY.

	H-377	T-419	T-429	H-431	T-694	T-491
SiO_2	54.0	64.2	64.9	55.9	57.4	60.2
Al_2O_3	1.75	15.1	19.2	24.8	22.8	13.5
Fe_2O_3	2.40	4.48*	0.71	2.14*	1.51*	6.72*
FeO	9.48		0.37			
MgO	7.45	2.15	0.04	0.29	1.80	2.39
CaO	15.5	3.19	0.55	0.82	1.62	5.95
Na_2O	1.07	7.60	8.61	9.18	5.67	5.56
K_2O	0.29	2.11	4.77	6.29	6.09	4.71
H_2O^+	0.15	–	0.39	0.41	1.20	0.02
H_2O^-	0.66	0.32	0.20	0.36	0.37	0.37
CO_2	0.27	0.10	0.15	0.45	0.70	0.35
TiO_2	0.14	0.97	0.03	0.19	0.19	0.23
P_2O_5	0.26	0.16	0.0	0.11	0.16	0.71
S	0.02	0.01	0.01	0.01	0.01	–
MnO	0.41	0.05	0.03	0.03	0.06	0.20
Totals	93.8	100.4	100.0	101.0	99.5	100.8
S.G.	3.20		2.56			

*Fe_2O_3 and FeO are combined.

SAMPLES (For location see Figure 2).

H-377 – Syenite pegmatite (Map-unit 5e), altered, east of Highway 41.
T-419 – Lineated syenite (Map-unit 5f), South of Mud Lake
T-429 – Sandy, leucocratic syenite (Map-unit 5c), South of Lake Clear.
H-431 – Nepheline syenite pegmatite (Map-unit 5e), South Algona Township
T-694 – Hydronephelite bearing syenite pegmatite (Map-unit 5a), South Algona Township.
T-491 – Pyroxene syenite (Map-unit 5c), South Algona Township.

zonite (map-unit 6a) weathers pink, is coarse grained, with a well developed lineation, and a gneissic structure where metasedimentary layers are present. Granite pegmatite dikes have intruded this body, but the contacts of the dikes with the host rock are not well defined. In general this body is very inhomogeneous. This is due to a great extent to the amount of contamination involved. Numerous pyroxenite dikes are also present, and are characterized by sharp contacts with the enclosing rock and are more abundant where contact metamorphism and metasomatism appear to be dominant. There are areas within this body which are characterized by very coarse grained quartz in variable amounts, from 5 to 50 percent. Patches of quartz-rich and quartz-poor phases are present within these bodies and very often are found together. Their composition (Table 6) varies from albite quartz monzonite to granite (Ayres 1972).

About 0.4 km south of Opeongo Road and on a road leading to Schavens Lake the contact of the granite with the metasediments is exposed and is char-

TABLE 6 | MODAL AND CHEMICAL COMPOSITION OF THE FELSIC INTRUSIVE ROCKS.

CHEMICAL ANALYSES (WEIGHT PERCENT)**

	T-1126	T-421B	T-528	T-532	T-542B
SiO_2	69.5	71.1	73.6	70.1	74.0
Al_2O_3	17.0	15.5	13.5	15.9	13.9
Fe_2O_3	0.80*	0.33	1.53	0.73	0.66
FeO		0.37	0.52	0.22	0.59
MgO	0.43	0.33	0.20	0.50	0.25
CaO	0.32	0.13	0.28	0.44	0.17
Na_2O	3.90	4.25	4.14	7.22	6.13
K_2O	6.02	7.25	5.33	3.65	3.43
H_2O^+	0.05	0.16	0.06	0.10	0.0
H_2O^-	0.38	0.20	0.24	0.26	0.30
CO_2	0.10	0.10	0.10	0.25	0.13
TiO_2	0.09	0.01	0.02	0.03	0.19
P_2O_5	0.05	0.0	0.01	0.01	0.01
S	0.04	0.0	0.01	0.0	0.01
MnO	0.01	0.01	0.02	0.03	0.03
Totals	98.6	99.8	99.7	99.5	99.8
S.G.		2.58	2.62	2.57	2.56

MODES (VOLUME PERCENT)

	T-1136A	T-1136C	H-642	T-573	H-296	H-402	T-542C	T-527
Quartz	30.2	49.9	38.4	49.0	38.4	22.8	51.8	15.1
Plagioclase	27.3	25.3	17.3	8.9	15.4	20.7	24.7	37.8
Microcline	38.7	13.8	9.2	0.8	26.6	36.5	20.8	18.6
Orthoclase	0.7	2.9	35.0	34.0	18.5	14.6	1.1	21.9
Opaque	1.1	2.0	0.9	1.9	0.06	1.7		
Biotite	0.12	1.7	0.01	3.6		3.2		1.4
Sphene		1.0					0.7	0.13
Hornblende	1.9	4.2					0.5	
Zircon				0.7			0.12	0.08
Carbonate								1.6
Sericite					0.9	0.3		
Radioactive Minerals								2.0
Totals	100.02	100.8	100.81	99.8	99.86	99.8	99.72	99.68

**Chemical analyses by Geoscience Laboratories, Ontario Geological Survey.

* Fe_2O_3 and FeO are combined.

SAMPLES (For Locations, see Figure 2)

T-1126 — Albite quartz monzonite, Lake Clear.

T-421B — Albite quartz monzonite, pegmatite, south of Mud Lake.

T-528 — Albite quartz monzonite, south of Hwy. 512, Grattan Township.

T-532 — Albite quartz monzonite, south of Hwy 512, Grattan Township.

T-542B — Albite quartz monzonite, boundary of Sebastopol-Grattan Townships.

T-1136A and C — Albite quartz monzonite.

H-642 — Albite granite.

T-573 — Albite granite

H-296 — Albite granite

H-402 — Albite granite

T-542C — Albite quartz monzonite, altered.

T-527 — Albite quartz monzonite.

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Photo 8–Pseudopebbles in albite quartz monzonite. Rims of pyroxene enclose coarse grained groundmass of quartz, potassic feldspar and pyroxene. On road to Schavens Lake, 0.4 km south of Opeongo Road.

acterized by very coarse grained pyroxene skarns in nests and patches. The skarns consisting of pyroxene, scapolite, carbonate and feldspar, are found in recrystallized calc-silicate gneiss which is irregularly veined by pyroxene-rich material. Pseudopebbles are present here (Photo 8) which consist of rims of pyroxene around feldspar-quartz groundmass with an overall rounded to subrounded, elliptical shape. This area is considered by the author to be part of the metamorphic aureole of the granite body.

LITTLE LAKE CLEAR STOCK (ALBITE QUARTZ MONZONITE)

This albite quartz monzonite body extends from Highway 512 eastwards to the Grattan-Sebastopol Townships boundary, a distance of approximately 7.5 km, and has a maximum width of 4.2 km. This body is usually leucocratic with less than 5 percent mafic minerals, except where contaminated. It weathers light pink and is massive to gneissic. The gneissosity is defined by the metasedimentary layers, or syenitic layers within the quartz monzonite. It has inclusions of amphibole-rich gneiss, syenite, nests and patches of pyroxene hornfels (argillite), marble, feldspathic arenite, and scapolite skarns. Granite pegmatite and syenite pegmatite dikes and patches are late intrusive rocks found within the granitic rocks; also present are pyroxenite dikes, quartz veins and calcite veins. This rock also exhibits pseudopebble texture very similar to the one observed in the Basils Lake stock, with the same mineralogy of the rim and the groundmass (see Photo 8). In general this structure is found in areas of scapolitization, pyroxene enrichment, incipient pegmatization, and close to the contact of the intrusive rocks with the metasediments.

A great portion of this albite quartz monzonite body is in contact with the clastic siliceous metasediments (Grattan-Sebastopol Townships boundary). This particular contact area of the albite quartz monzonite is characterized by more than 20 percent metasedimentary inclusions and minor patches of syenite and granite pegmatite. Within this zone, mineralization was detected by the field party. Several radioactive showings of thorite mineralization, which has variable amounts of uranium, were found within 0.5 km of the contact of the feldspathic arenite and the granitic stock. Also present in the same area are concentrations of rare earth elements (see Economic Geology). Apatite veins and patches in association with calcite veins are concentrated within this body in a fracture zone which trends north-northwest through properties 6 and 5. This zone was traced for about 2.7 km, where massive and disseminated apatite occurs within it.

Cataclastic quartz monzonite rocks were observed along the Shamrock Fault in thin shear zones, with accompanying hematization and slickensides. The albite quartz monzonite is weakly foliated and gneissic due to the sheeted arrangement of included metasedimentary bands.

In thin section these rocks are seen to consist of variable amounts of microcline, orthoclase, albite (with minor sericitization) and quartz which is found in ribbons, and elongated and angular grains. Other phases present include biotite, and sodic amphibole. Accessories present are apatite, sphene, zircon, thorite, and iron oxides. They possess a granular to foliated structure (quartz elongation). Several other small bodies of albite quartz monzonite occur within the map-area and are less than 2 km in diameter. They are very similar to the rock types described above.

Chemical analyses from the Little Lake Clear albite quartz monzonite (Table 6, samples T-1126 and T-542B), are low in CaO, FeO, and moderately high in SiO_2, and in Na_2O and K_2O as compared to Nockolds (1954) average quartz monzonite.

UNMETAMORPHOSED PLUTONIC ROCKS

Mafic Intrusive Rocks

DIABASE

A few small (less than 5 m wide) diabase dikes (map-unit 7c) occur within the map-area. They are fine to medium grained, massive, and weathered green to black. Most of them are found cross-cutting marble, clastic siliceous

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Photo 9–Photomicrograph (40X) of medium-grained diabase, showing doleritic texture. Approximately 0.5 km southeast of Perrault Lake.

metasediments and gabbro.

In thin section the fine-grained variety is seen to consist of phenocrysts of andesine-labradorite plagioclase, set in a groundmass (less than 0.1 mm) of augite and plagioclase. The medium-grained diabase shows a doleritic texture (Photo 9) (Moorhouse 1959), consisting of plagioclase (70 percent), interstial augite (20 percent) and magnetite (10 percent).

DIORITE

A few very thin, less than 1 m wide, diorite dikes (map-unit 7a) were found cross-cutting the gabbro and syenite bodies but are more abundant within the Woermke metagabbro.

In thin section, they are seen to consist of quartz, plagioclase, amphibole, and biotite. Other phases include magnetite. They are medium grained, massive, and have a granoblastic texture.

PYROXENITE

The pyroxenite dikes (map-unit 7b) are very small (less than 1 m in width) and have sharp boundaries with respect to the host rocks. They are massive, coarse grained, and weathered olive green. The host rocks of these dikes are quartz monzonite, syenite (gneissic syenite, amphibole-pyroxene syenite) and feldspathic arenite (close to the contact with syenite or quartz monzonite). They are composed mainly of diopside with minor euhedral to subhedral apatite, sphene, scapolite, microcline and in one place thorite crystals.

HORNBLENDITE

The hornblendite dikes (map-unit 7d) are very small (less than 50 cm in width) and have sharp boundaries with respect to the host rocks (gneissic syenite, Grattan Township). They are massive and coarse grained and are composed mainly of hornblende with minor augite and feldspar.

Felsic and Alkalic Intrusive Rocks

GRANITE PEGMATITE

Pods, lenses, stringers and irregularly-shaped bodies of granite pegmatite occur in the map-area. These pegmatites are pink and white, massive and have defined borders. The pegmatites of the map-area are of two types: (1) pegmatite composed essentially of microcline, perthite, quartz, and plagioclase, in graphic intergrowth, and (2) pegmatite composed of large, pure, individual crystals of quartz and feldspar over 30 cm in size, in a matrix of coarsely crystalline quartz, feldspar and accessories (tourmaline, hornblende). A number of the latter pegmatites occur in Grattan Township (Collautti feldspar quarry). Accessories in the pegmatites include tourmaline, hornblende, diopside and minor radioactive minerals. These pegmatite dikes vary in size from few metres up to 70 m in width. Their host rocks are quartz monzonite, metagabbro, syenite, marble and feldspathic arenite.

SYENITE PEGMATITE

Pods, lenses, stringers, irregularly-shaped bodies and dikes of syenite pegmatite, occur throughout the area but they are more common in Sebastopol and South Algona Townships. Their host rocks are feldspathic arenite, quartz monzonite and syenite. The syenite masses are usually thin, less than 2 m wide sheets but are coarse grained and composed of interlocking grains of feldspar and pyroxene. A body of coarsely crystalline syenite pegmatite, located within map-unit 5c, consists of several masses of syenite pegmatite identical in composition and ranging from 5 to 40 m in width, and has a gradational contact zone with the host rock. This pegmatite has some feldspars exceeding 20 cm in diameter, contains minor mafic minerals and occurs about 0.8 km west of Little Lake Clear.

Paleozoic[1]

ORDOVICIAN

LIMESTONE AND SHALE

Previous known work on the Ordovician rocks in the area includes two well documented reports by E. Billings (1858), and by G.M. Kay (1942). The latter report goes into much greater detail and contains an excellent map outlining the extent of the Paleozoic rocks within the west end of the map-area.

The two major occurrences of Paleozoic rocks within the area are at the extreme northeast corner of the map-area and at the southwest end of Lake Clear. The latter area contains two distinctly different rock types: (1) black calcareous shale (map-unit 9e), and (2) silty limestone (map-unit 9d) both of which are of Ordovician age (Kay 1942).

The calcareous shale (map-unit 9e), the younger of the two sedimentary units, is typified by its light to dark brown colour and calcareous cement/matrix. It is best exposed approximately 0.4 km up Neilan Creek in a 1.9 m thick by 14.5 m long exposure. Here well preserved fossil fauna (cephalopods, crinoids, graptolites, brachiopods, trilobites and bryozoans) reportedly typical of the Whitby Formation, Collingwood shale (Kay 1942) are found in abundance. The base of this exposure represents the transition to the underlying silty limestone, which comprises more than 80 percent of the Paleozoic rocks present in the area.

The silty limestone (map-unit 9d) is best exposed south of Lake Clear at the creek entrance west of Hanes Island, and in several other large outliers outside the map-area south of the west end of the lake. The total thickness of the silty limestone which has been correlated with the Cobourg Formation (Kay 1942) is estimated at 45 to 48 m. Basically, this unit is composed of light to dark grey medium to coarse textured limestone with shale partings, and minor intraformational conglomerate.

Two other small outliers in the area include a 10 m thick exposure of moderately dipping slaty limestone (map-unit 9c) 5.6 km east of Lake Clear at Esmonde. This formation has been designated as the Sherman Falls Formation (Kay 1942) and is therefore believed to underlie the silty limestone (Cobourg Formation, map-unit 9d), and consists of slaty grey limestone with shale interbeds. Sugary textured limestone and dolostone which is buff grey on the weathered surface has been correlated with the Rockland Formation by Kay (1942). If this correlation is correct this could be the oldest Paleozoic unit in the area. It is found in two small outliers, on the north shore of Lake Clear near the west end of the lake, and has been down faulted by the Shamrock Fault.

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[1]This section of General Geology was written by C. Houle, Geological Assistant, Ontario Geological Survey.

The largest area of Paleozoic rocks, in the northeast corner of the map-area, is grey to buff shaly limestone and dolostone (map-unit 9 b), extensively bedded and containing an abundance of well preserved fossil fauna. These rocks have been correlated by Kay (1942) with the Hull Formation, which overlies the Rockland Formation, and lies beneath the Sherman Falls Formation (Kay 1942), (map-units 9a and 9c respectively on the map). The Bonnechere Lime Company Limited operated a larqe quarry within this unit, just south of Eganville.

The presence of the Paleozoic sedimentary rocks within the map-area is attributable to the presence of at least two faults, the Mount St. Patrick, and the Shamrock which are part of the Ottawa Bonnechere rift system (Kay 1942) and in each case appear to have downfaulted the Paleozoic rocks.

Cenozoic

QUATERNARY

Pleistocene

Glacial striae obtained from north of Lake Clear indicate that the direction of ice movement was N72E in the lowlands of the Ottawa- Bonnechere Graben. However no glacial striae were observed by the author and his assistants in the Madawaska Highlands south of Mount St. Patrick Fault. Hewitt (1954) stated that the direction of ice movements as indicated from glacial striae was S15E in the Madawaska Highlands, Brudenell Township.

The Pleistocene deposits are glacial and glaciofluvial. South of the Mount St. Patrick Fault there is a series of well developed recessional moraines. These moraines are long narrow ridges of boulder drift extending in an east-west direction parallel to the direction of the ice front (Chapman and Putnam 1966; Hewitt 1954). They are best developed north of Newfoundout and south of Rileys Lake. Outwash sands and gravels were found in the Ottawa Bonnechere Graben lowlands. They extend from west of Lake Clear eastwards to Dacre (outside map-area), along the northern boundary of the Mount St. Patrick Fault (Chapman and Putnam 1966). They were also found in the Madawaska Highlands along valleys as river terraces, as well as south of Opeongo Road on Kregurs Creek, Sebastopol Township.

Recent

Swampy areas are found in the Ottawa-Bonnechere Lowlands and in the Madawaska Highlands, in the vicinity of Grassy Lake.

Peat deposits composed of dark organic mud produced by the partial decomposition and disintegration of mosses, trees and other plants occur in these areas and in shallow lakes and in beaver ponds in the map-area.

STRUCTURAL GEOLOGY

The map-area lies near the northern boundary of the Late Precambrian, Grenville Province, carbonate-rich metasedimentary belt, which is intruded by felsic and alkalic intrusions, and mafic rocks (Ayres *et al.* 1971; Lumbers 1980).

Owing to the high degree of metamorphism and destruction of original structures in the rocks, criteria for determination of tops of strata are lacking in the area. The structure of this part of the Grenville cannot be determined by stratigraphic methods.

Foliation and Gneissosity

Metamorphic foliation is typically present in the map-area. Foliation in the rocks of the map-area is defined by the subparallel orientation of minerals such as mica, amphibole, graphite, and quartz and by mineral layering. Metamorphic foliation is readily apparent within the metasediments as gneissic mineral layering and in the mica-rich varieties (map-unit 1g) as a well developed mineral foliation defined by preferred orientation of mica. A weak to well defined mineral foliation is common in the granitic rocks. This foliation is identified by the subparallel orientation of ribbons and elongated quartz grains.

Gneissosity defined by metamorphic mineralogical layering is common in the map-area particularly in the metasediments but also in some alkalic and felsic intrusions. In a few places, north of Lake Clear, in lot 30, concession IX, Sebastopol Township, quartz ribbons are aligned subparallel to the mineralogical layering (defined on the basis of 15-30 cm thick layers of mafic-rich and mafic-poor feldspathic arenite). In general the gneissosity trends to the northeast and dips shallowly to the southeast, but other attitudes were also observed.

Cataclastic foliation was observed along several shear and fault zones in the area. The cataclastic rocks range from mylonite gneiss to blastomylonite as defined by Higgins (1971). In thin section, cataclasis is demonstrated in a blastomylonite, from west of Little Lake Clear, by the structures observed in the feldspar porphyroclasts of an albite quartz monzonite, namely: bent crystals, deformation bands associated with the bent crystals, twin gliding, pull apart, microfaults, and rounding of the crystals as observed elsewhere by Themistocleous (1976). Also in a marble shear zone, (lot 24, concession XIV, Sebastopol Township) kinked, bent, and deformation bands were observed in rounded biotite porphyroclasts.

Lineation

Lineations in the map-area are relatively common in the syenite body, south of Lake Clear (map-unit 5f), and in the albite quartz monzonite bodies of Sebastopol Township but are rare in the metasediments. In general these lineations consist of elongated clots of amphibole-biotite in the syenite and elongated quartz grains in the albite quartz monzonite. Lineations generally plunge shallowly (15 to 30 degrees) to the southeast.

Joints

Joints are present near shear zones and faults in the map-area, and are poorly developed away from the structural disturbances. The major set of joints is subparallel to the Ottawa-Bonnechere faults. A stereographic plot (not shown) of joints attitudes observed from the vicinity of Mount St. Patrick Fault and Shamrock Fault indicated a sharp maxima of subvertical to vertical joints striking S75E. The two faults conform to this trend. Joints observed elsewhere appear to have two trends, one subparallel to the above mentioned and one trending north-northeast and dipping 45-75 degrees to the east; this trend conforms to the north-northeast trending faults. Some of the joints in the Mount St. Patrick Fault area are characterized by hematization and calcite veins.

Folding

Information on folding consists solely of strikes and dips of metamorphic foliation and gneissosity and depends on tracing marker horizons where available. Information from drag-folding and lineations helps to construct the structural history of the area.

The general foliation and gneissosity in the metasediments undulates between north and east-northeast with the predominant trend being to the northeast except in the northeast part of the area where the trend is north to northwest. Dips of foliation and gneissosity are with few exceptions southeasterly to easterly between 70 and 20 degrees. This indicates that the general fold axial planes in the area must be tilted towards the west and northwest and recumbent isoclinal folds predominate (Figure 3).

South of Neumans Lake the foliation and gneissosity trend east to northeast and dip from 50 to 27 degrees to the south. This variation of dips represents recumbent isoclinal folding (Figure 3) with the axial plane tilted towards the northwest. South of Mount St. Patrick Fault and in the Newfoundout area the gneissosity and foliation trend northeast and dip southeast between 70 and 20 degrees. The gneissosity and foliation in the metamorphosed arenite-wacke sedimentary sequence west of McGrath Road and northeast of Meadow Lake, trend north and dip east from 79 to 30 degrees. This variation of dips together with tracing marker horizons, observed lineations, and drag folds outline an isoclinal folded sequence with a southerly trend of the fold axis.

A stereographic plot by the author of the gneissosity measurements obtained by Rose (1958) from the iron formation area (near Constant Creek), indicates isoclinally folded rocks with the fold axis trending S23W and plunging 30 degrees. A similar plot by the author from the Dick molybdenite occurrence indicates that the strata adjacent to the showing are folded and the fold axis trends westwards and has a subhorizontal plunge of 8 degrees. This is conform-

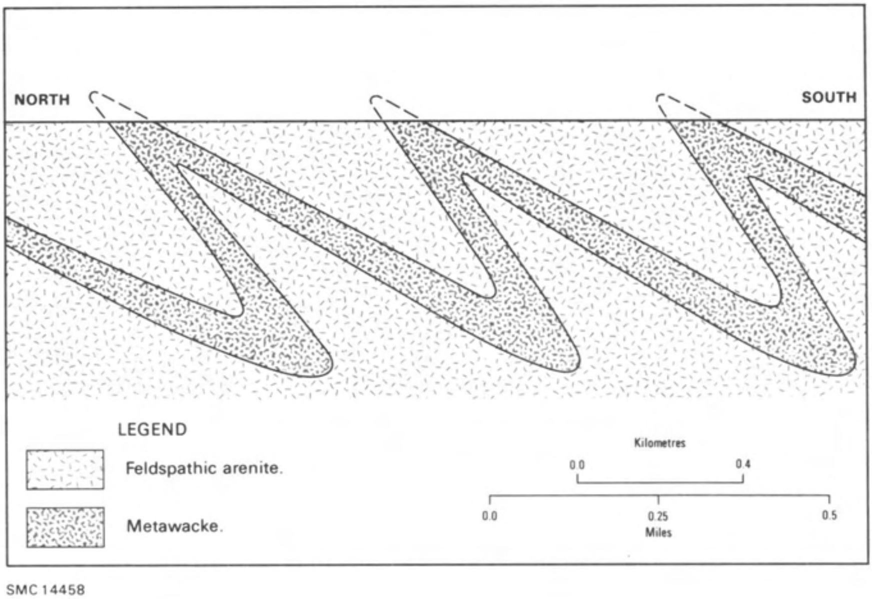

Figure 3–Simplified cross-section of recumbent isoclinal folds south of Neumans Lake.

able with the drag folds in the area. The hinge zone of the fold (Dick occurrence) is brecciated, sheared and enriched in sulphide-molybdenum mineralization.

A complexly folded metasedimentary sequence is present west of Highway 41 and east of Perrault Lake. The gneissosity and foliation trend from east to southeast, dipping north, south, and east. Drag folds in the area have shallow plunges to the north and south and the lineations plunge moderately southeast and northwest. The sequence has been folded along a north-south axis and refolded in an east-west direction.

Structures of different patterns of orientation are present within the map-area, such structures (minor folds, lineations) are assumed to be of different generations, which means that the nature and orientation of the strain increments changed during the history of the deformation.

Faulting

The area lies partly within the Madawaska Highlands and partly within the Ottawa-Bonnechere Graben system. The boundary of the two is the Mount St. Patrick Fault which is the southern boundary fault of the Ottawa-Bonnechere Graben.

Because of irregular, poorly distributed outcrop throughout most of the map-area, it is difficult to define faulting. In the map-area the location of the faults is based on the following evidence: (1) pronounced topographic scarps;

(2) airphoto and topographic lineaments; (3) shearing, brecciation, and cataclastic rocks; (4) slickensides; (5) hematization; (6) discordance or displacement of lithology; and 7) strongly developed joint sets.

The Mount St. Patrick Fault runs subparallel to the Opeongo Road. It is the major fault in the map-area, marked by a pronounced north facing scarp, localized joints, hematization, calcite veins, brecciation and displacement of lithology. Kay (1942) traced this fault for about 145 km in Lanark and Renfrew Counties. It trends N70W, and it is a normal fault which has a vertical throw of approximately 500 m (Kay 1942). Subparallel to the Mount St. Patrick Fault and of the same age is the Shamrock Fault which passes to the north of Lake Clear, to the northwest of Constant Lake and has a south facing scarp. It is characterized by hematization, slickensides, localized jointing which conforms to the fault trend, lithologic discordance and brecciation. The vertical throw on this fault as estimated by Kay (1942) does not exceed 70 m.

Other faults include a set of northeast-trending faults which are cross-cut and offset by the Ottawa-Bonnechere fault system.

Several shear zones were observed within the map-area, with a maximum width of 1 m and are characterized by formation of mylonite gneiss and blastomylonite. Two distinct trends were recognized, one S70E and the other N30E. The first subparallels the Ottawa-Bonnechere fault system and the second one the northeast-trending faults.

CORRELATION OF GEOLOGY WITH AEROMAGNETIC DATA

The Clontarf area was surveyed aeromagnetically in 1949, at a scale of 1:63 360 or 1 inch to 1 mile (GSC 1952). No definite pattern is observed, in the distribution of the highs and lows in the area, from superimposing the aeromagnetic data on the geological map.

The average magnetic background in the area is 1300 gammas. The high and low magnetic zones are only a few hundred gammas above or below that background except the Woermke metagabbro (2300 gammas) and the iron formation (2700 gammas).

The complex geology of the area is reflected in a very complex and broken-up pattern of magnetic intensities. In general the aeromagnetic highs in the map-area are characterized by rocks high in iron, which occurs either in mafic intrusive bodies, or in magnetite-bearing hornblende gneiss, or clastic siliceous metasediments such as arenite and wacke.

There is a marked contrast of the Woermke metagabbro and the adjacent metasediments and this is due to higher magnetite content of the metagabbro. Similarly higher magnetic response corresponds to the metagabbro body along the western flank of McDonalds Mountain. It should be emphasized, however, that no magnetic contrast exists in the highly magnetic metagabbro body southeast of Mud Lake. Also, west of Philips Lake outside the map-area, an extension of the Woermke metagabbro corresponds to a magnetic low. The pronounced magnetic low around Perrault Lake also corresponds to a metagabbro body. The iron formation northwest of Constant Lake masks any contrast between the arenites and the amphibolite (host of iron formation). Directly to the north of this iron formation two small highs correspond to 15 percent disseminated magnetite in arenite and wacke. The marbles appear to underlie broad low magnetic areas and they have very low magnetic response.

The alkalic intrusions are characterized by high and low anomalies. The highs probably reflect mafic-rich areas and the lows mafic-poor areas of the alkalic bodies.

ECONOMIC GEOLOGY

Prospecting and Mining Activity

The Clontarf area contains a variety of metallic and non-metallic mineral deposits. Metallic mineralization consists mainly of uranium occurrences, sulphide mineralization and iron. Molybdenite is also present. Non-metallic mineral deposits of past and recent interest include apatite, stone, mica, feldspar, nepheline, marl, and zircon. Sand and gravel deposits are used in local road construction.

The first recorded interest in the mineral deposits within the map-area dates back to 1880; apatite as a source of phosphorous was the first mineral to be mined in the area. Three former apatite mines, the Smart, Meany and Turners Island, were operated in 1880, but the mineral production was very limited. The Turners Island deposit was explored in 1943 for rare earth element minerals (Satterly 1945).

In 1900, Canada Iron Furnace Company discovered a magnetite iron formation in a metasedimentary sequence east of Highway 41. The same company developed this magnetite deposit into a producing mine in 1901 and operated it until 1907 (Satterly 1945). In 1951 Algoma Ore Properties Limited optioned the property (Gilbert 1951). In 1918 a molybdenite occurrence, in Grattan Township, was investigated by small test pits over a length of 85 m (Satterly 1945).

The Bonnechere limestone quarry located in the northeast corner of the map-area was opened and operated around 1920. This property was acquired by the Shane Lime and Charcoal Company Limited of Eganville in 1942. Limestone was also quarried in 1880 from north of Opeongo Road and used in the construction of the Esmonde Church (Satterly 1945). In 1942 and 1943, G. Colautti operated a feldspar quarry west of Highway 41 (Satterly 1945).

Exploration for uranium was carried out by Opeongo Mines Limited, during 1956, in Sebastopol Township south of Lake Clear, and one radioactive showing west of Kregurs Creek on the Opeongo Road was trenched.

The only activity in the map-area in 1977 was the staking of two claims in Grattan Township (lot 16, concession VIII) by L. Smith.

Metallic Mineralization

IRON

Magnetite occurs as: (1) massive layers and lenses within hornblende-plagioclase gneiss (map-unit 2d); (2) disseminations in feldspathic arenite (map-unit 1b), biotite-quartz-feldspar gneiss (map-unit 1g), and hornblende-plagioclase gneiss (map-unit 2a); (3) magnetite segregations in metagabbroic rocks; and (4) disseminations in lineated syenite (map-unit 5f). Magnetite also occurs as discontinuous massive layers, up to 7.5 m thick within hornblende-plagioclase gneiss in the former Radnor mine, lot 16, concession IX, Grattan Township. Magnetite is found also in a biotite-quartz-feldspar gneiss (calcareous wacke, map-unit 1g) as disseminated coarse aggregates of up to 30 percent magnetite in lot 12, concession XI, Grattan Township.

Disseminated magnetite is present in small amounts, usually less than 5 percent, in almost all biotite-quartz-feldspar gneiss (wacke, map-unit 1g), hornblende-quartz-plagioclase gneiss (map-unit 2a), and feldspathic arenite (map-units 1a and 1b).

The Woermke metagabbro in Sebastopol Township, stands out as a prominent magnetic anomaly of 2300 gammas; this might be due to primary igneous segregations of iron oxide minerals.

Magnetite is also found on McDonalds Mountain in the lineated syenite. The nepheline syenite gneiss and pegmatites also have up to 5 percent disseminated magnetite.

MOLYBDENUM

Molybdenite was observed in two places within the map-area: (1) scattered flakes within granite pegmatite and/or quartz veins in lot 11, concession XI, Grattan Township (property 1), and (2) patches of molybdenite-pyrite within a narrow pegmatitic granite (less than 90 cm wide) which cross-cuts calc-silicate gneiss in lot 20, concession V, Grattan Township.

SULPHIDE MINERALIZATION

Minor disseminated pyrite and pyrrrhotite occurs within: clastic siliceous metasediments, north and south of Neumans Lake, southwest of Newfoundout in Sebastopol Township, east and northeast of Duffys Lake, and west of Constant Lake on Highway 41, in Grattan Township; and in calcareous metasediments with minor chalcopyrite and molybdenite, in lot 11, concession XII, Grattan Township. Metagabbro containing a few massive pyrite veinlets usually less than 2 cm across, occurs on lot 14, concession VI, in Sebastopol Township. Pyrite-pyrrhotite veinlets up to 8 cm in width are present within calc-silicate gneiss (map-unit 2b) and hornblende-plagioclase-quartz gneiss (map-unit 2a), in lot 20, concessions V and IV, respectively, in Grattan Township.

Sulphide mineralization in massive form was observed by the writer in several places and in different rock types, in: (1) marble, (2) hornblende-biotite-plagioclase gneiss, (3) metagabbro, and (4) gneissic syenite. A description of these occurrences is given below.

1) Sulphide rich layers and lenses occur in marble (map-unit 3a) lot 34, concession II Sebastopol Township and lot 36, concession VI Grattan Township, near Newfoundout. These sulphide occurrences contain 40 to 50 percent combined pyrite and pyrrhotite, and are up to 3 m in width. This sulphide-rich zone was observed in three places along a strike length of about 1 km and across a 1 to 3 m width.

2) Possible syngenetic massive sulphides, with 20 to 30 percent combined pyrite-pyrrhotite, were observed in three completely overgrown trenches in the hornblende-biotite-quartz-plagioclase gneiss (map-unit 2a) north of Lake Clear, in lot 33, concession XI, Sebastopol Township, however there is no public record of this work. This scattered mineralization occurs along a strike length of about 300 m and is up to 1 m in width. A grab sample taken by the author from one of these trenches and analyzed by the Geoscience Laboratories, Ontario Geological Survey, returned the following values: 0.056 percent copper, 40.9 percent sulphur and trace gold and silver (Table 7). The total extent of the mineralization is not known.

3) Sulphide mineralization occurs along the western flank of McDonalds Mountain, within a metagabbro (map-unit 4e) body. The mineralized showing is an overgrown trench 1 m wide by 2 m long, and pyrite-pyrrhotite make up about 25 to 30 percent of the host metagabbro. This gabbro intrudes metamorphosed wacke (map-unit 1g) and arenites (map-units 1b,c) and is intruded by syenite (map-unit 5) and by several granite pegmatite dikes. The granite pegmatite dikes are more abundant in the syenite and are radioactive. This metagabbro is massive, medium to coarse grained, and in sharp contact with the syenite. The metagabbro has a width of approximately 0.2 km in the vicinity of the mineralization. Contact metamorphism effects appear in parts of the western part of the body. Two exposures located approximately 0.3 km to the south of the trench consist of angular white fragments (scapolite + feldspar) ranging from 1 cm to 20 cm in diameter, and minor feldspathic fragments, in a mafic-carbonate groundmass. These exposures seem to be scapolitized carbonate tectonic breccia with limy mud and feldspathic fragments. A grab sample taken by the author from the mineralized showing and analyzed by the Geoscience Laboratories, Ontario Geological Survey, returned the following values: 740 ppm copper, 146 ppm zinc, 170 ppm nickel, 0.02 ounces per ton gold and trace silver (Table 7).

4) Pyrite-pyrrhotite and chalcopyrite up to 10 percent combined occur in gneissic syenite (map-unit 5b) 3 km north of Meadow Lake, in lots 34 and 35, concession XVI, Grattan Township. This mineralization is indicated by more than a dozen rusty gossan zones that are up to 2 by 20 m in size and were observed within a 360 m long and 6 to 18 m wide zone. This mineralized syenite intruded metamorphosed arenite and the sulphide mineralization is possibly related to these metasediments. Selected samples taken by the writer from this locality and analyzed by the Geoscience Laboratories, Ontario Geological Sur-

TABLE 7 | ASSAYS FOR PRECIOUS AND BASE METALS FROM THE CLONTARF AREA (BY GEOSCIENCE LABORATORIES ONTARIO GEOLOGICAL SURVEY).

	Gold	Silver	Copper	Zinc	Molybdenum	Sulphur	Ni	Total Fe	Ti
T-207				<0.10%	<0.01%				
T-147	trace	trace	313 ppm	92 ppm					
T-176	"	"	16 ppm	7 ppm					
T-227	0.02 oz/T	"	740 ppm	146 ppm			170 ppm		
T-544	trace	"	660 ppm	53 ppm					
T-544	"	"	560 ppm			40.9%			
H-392	0.01 oz/T	"	2900 ppm		2.4%	35.4%			
H-417	"	"	330 ppm	trace					
T-541	"	"	550 ppm	105 ppm					
T-760	"	"	–	140 ppm					
T-984	–	"	–	134 ppm					
T-875	–	"	37 ppm	91 ppm					
T-201	10 ppb	3 ppb	240 ppm	–					
T-377			20 ppm	540 ppm					
T-1-3								54.0%	1.74%

SAMPLES (For location, see Figure 2).
T-207 – Rusty, graphitic, quartzofeldspathic gneiss.
T-147 – Amphibolite.
T-176 – Rusty quartzite.
T-227 – Sulphide zone in gabbro.
T-544 – Sulphide zone in calc-silicate.
T-392 – Pyrite vein cutting granite.
H-417 – Sulphide zone in syenite.
T-541 – Sulphide zone in diopside skarn.
T-760 – Sheared feldspathic arenite.
T-984 – Rusty quartzofeldspathic gneiss.
T-875 – Quartzofeldspathic gneiss.
T-201 – Pyrite seams and veinlets in quartzofeldspathic gneiss.
T-377 – Syenite.
T-1-3 – Ironstone.

vey, returned the following values: 0.06 to 0.01 percent copper, less than 0.01 percent zinc, and trace gold and silver (Table 7).

Radioactive Mineralization

MINERALOGY

Radioactive minerals were found as disseminated euhedral crystals of thorite up to 6 cm by 7 cm (T-615, Figure 4) and as aggregates of small subhedral crystals in fractures (T-596, Figure 4).

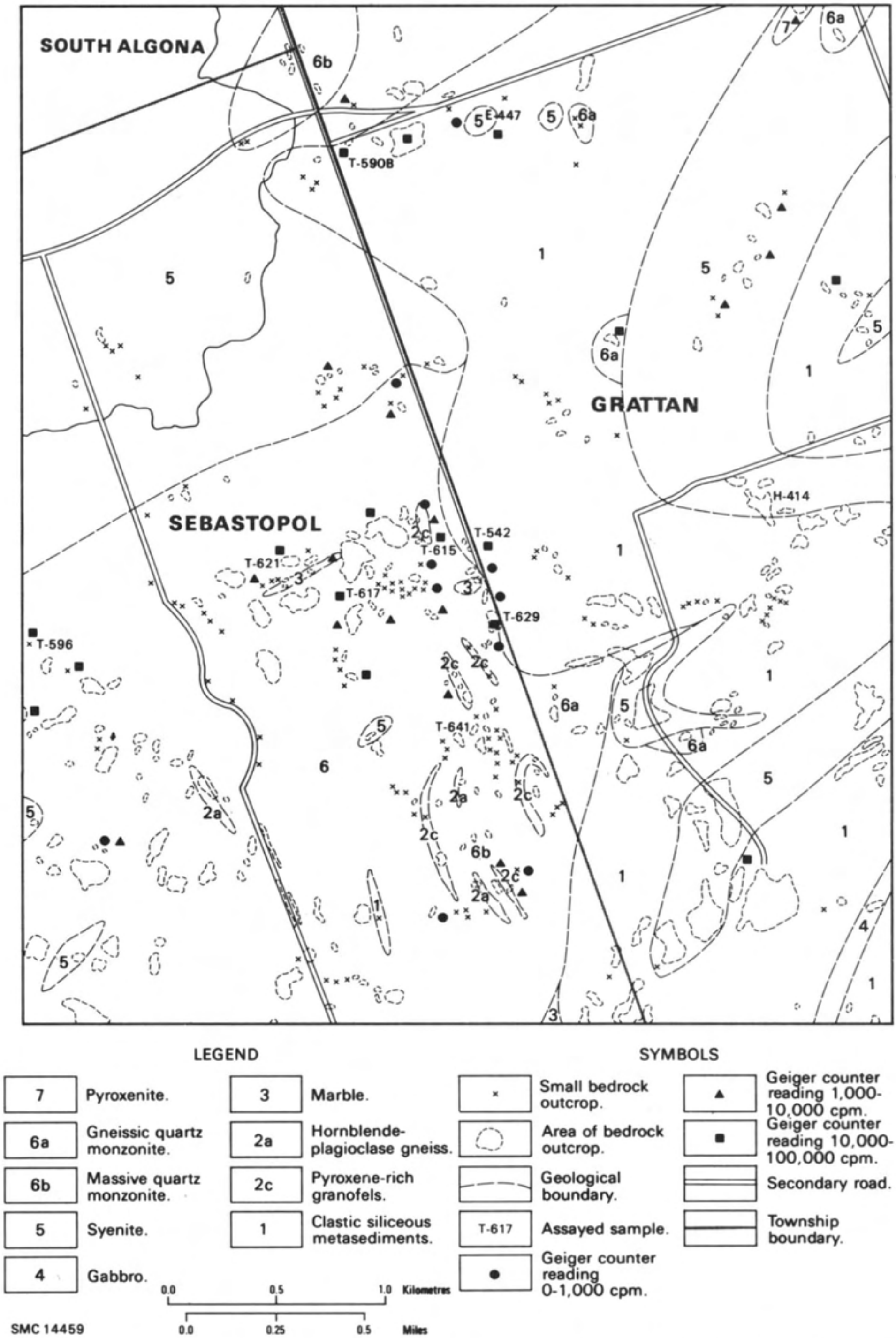

Figure 4–Geiger counter survey and assayed sample locations in an area of radioactive mineralization and rare earth element mineralization. See Table 8 for assays.

The radioactive mineralization occurs predominantly as metamorphic deposits, in which the predominant host rocks are pyroxene-rich granofels, quartz monzonite to syenite, and meta-arenite, as well as minor pegmatitic deposits in which the predominant host rock is pegmatite granite and pyroxenite dikes.

Uranium mineralization is recognized by (1) red discolouration, (hematization) (Satterly and Hewitt 1955; Satterly 1957; Bright 1976), and (2) radiating fractures around metamict porphyroblasts which are typical of the radioactive minerals.

GEOLOGY

The western part of the map-area is mainly underlain by a large quartz monzonite body which intruded syenite in the west and north and clastic siliceous metasediments in the east. The contact of the metasediments with the quartz monzonite is an area of considerable mixing and local radioactive mineralization is characteristically associated with a gradational contact zone from quartz monzonite to arenite.

The mixed contact zone (see Figure 4) characteristically contains lenses, irregular pods and patches of pyroxene granofels, and marble, lenses of hornblende-plagioclase gneiss, and dikes, veins and patches of granitic and syenitic pegmatite. The pegmatitic bodies are characterized by a grain size of less than 3 cm. The pyroxene-rich granofels is made up of 90 percent diopside with minor quartz, biotite, and microcline. This unit is found in massive bodies in contact with, or close to, minor marble patches, and in places it contains remnants of quartzite (Photo 10) up to 1 m wide. This rock type was traced intermittantly for about 1.8 km in a 60 m wide, north-northwest trending zone in the vicinity of the H. Lesner (Eganville) farm, in concessions XI and XII of Sebastopol Township, 150 m west of the Sebastopol-Grattan Townships boundary (Figure 4). Uranium mineralization in this area was discovered by the writer within and close to the pyroxene granofels unit.

The mineralized feldspathic arenite (map-units 1a, 1b) is characterized by microcline and quartz and exhibits a pink colour. Irregular pegmatitic patches of granite-syenite are also present, within the feldspathic arenite.

Some uraniferous pyroxene patches and dikes are present within quartz monzonite in association with granite and/or syenite pegmatite. Similarly wherever there is radioactive mineralization within the meta-arenite it is associated with pyroxene-rich veins or lenses. The quartz monzonite of the mixed contact zone has the mineral assemblage pyroxene-quartz-microcline. From the above the writer concludes that pyroxene may have acted as a chemical precipitant for uranium minerals. These areas will be favourable horizons for radioactive minerals.

Minor radioactive pegmatite deposits in which the host rocks are pegmatite granite and pyroxenite dikes are also present. The pegmatite granites are usually coarse grained (greater than 3 cm), with graphic intergrowth of quartz and microcline; the major mineral constituents are quartz, microcline, perthite and minor tourmaline and hornblende.

The pyroxenite dikes are dark green, and consist of pyroxene with a few eu-

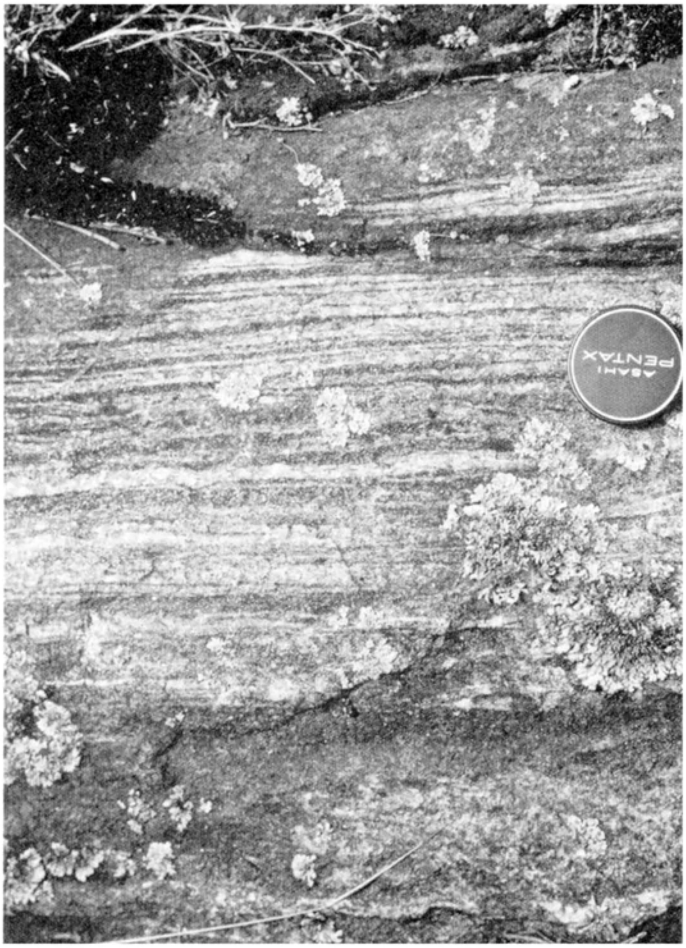

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Photo 10–Remnant of quartzite in pyroxene granofels (enlarged portion of Photo 1). Lot 34, concession XI, Sebastopol Township.

hedral microcline crystals and/or a few glassy brown-red thorite grains. These dikes are thin, less than 1 m in width, with sharp contacts; they are found within quartz monzonite and syenite bodies.

In summary uranium mineralization occurs in late granite pegmatite, pyroxenite dikes, albite quartz monzonite, feldspathic arenite, and pyroxene-rich granofels. Substantial quantities were discovered only in the contact zone of the albite quartz monzonite with the arenite. The areas of uranium mineralization in the contact zone are characterized by the presence of the following:

1) contact of the albite quartz monzonite with arenite (map-unit 1);
2) irregular pyroxenite dikes (map-unit 7b);

3) irregular pyroxene-rich granofels (map-unit 2c);
4) irregular carbonate metasediments (map-unit 3b,c);
5) quartzite (map-unit 1e); and
6) granite pegmatites (map-unit 8a).

GEIGER COUNTER READINGS

During the field season a reconnaissance scale field check for uranium was carried out using a McPhar scintillometer TC 33 which gives measurements in total counts. In general using this instrument, the normal background count in the Clontarf area was in the order of 80 to 100 counts per second.

From the assays obtained from several locations (Table 8, Figure 5), it was not possible to interpret the geiger readings quantitatively. This is probably due to considerable variation of the amount of uranium carried by the radioactive minerals.

Radioactive showings from this survey (Figure 5) were sampled by the writer and assayed for uranium, potassium and thorium. Twenty-two of the selected grab samples collected by the field party from Sebastopol and Grattan Townships were analyzed by the Geoscience Laboratories, Ontario Geological Survey, and returned values as high as 0.68 percent U_3O_8 (see Table 8, Figure 5).

RARE EARTH ELEMENTS

Rare earth elements concentrations have been determined from 16 plutonic rocks (Table 9, Figure 5) in the Clontarf area, including albite quartz monzonite (map-unit 6), nepheline syenite pegmatite (map-unit 5e), syenite (map-unit 5c), and a pyroxenite dike (map-unit 7b).

Table 9 shows a noticeable fluctuation of rare earth elements concentrations even within a small area (T-615 to T-629, Figures 4,5). The rare earth element content change is attributable to local processes such as contamination or vapour transfer. The albite quartz monzonite in the contact zone with arenite contains 10 to 20 percent inclusions of metasediments which are partly assimilated by the felsic intrusive body, so that change in rare earth elements is attributed most likely to this contamination.

Figure 6 illustrates a reverse relationship between the U_3O_8 and the rare earth elements Ce, Nd, La in the Sebastopol-Grattan Townships area (Figure 4). As the U_3O_8 decreases, the REE content increases.

TABLE 8 RESULTS OF ASSAYED RADIOACTIVE SAMPLES, COLLECTED FROM THE CLONTARF AREA. ASSAYS BY GEOSCIENCE LABORATORIES, ONTARIO GEOLOGICAL SURVEY.

Sample	Location* (Township, concession. lot)	% Uranium Oxide (U_3O_8)	% Potassium	% Thorium
H-414	G,16,33	0.51	1.22	7.6
T-561	G,12,26	0.01	1.30	0.29
T-542	S,12,34	0.29	–	10.8
T-590B	G,18,36	0.02	3.00	2.5
T-596	S,12,29	0.10	0.48	12.3
T-615	S,12,34	0.68	0.28	13.6
T-617	S,12,34	0.18	1.50	10.1
T-617	S,12,34	0.004	4.36	1390 ppm
T-621	S,12,32	0.45	4.64	7.8
T-629	S,12,34	0.37	0.56	11.7
H-447	G,18,35	0.00075	5.82	2590 ppm
H-377	G,14,16	0.17	–	3.3
H-389	G,13,17	0.0025	7.43	960 ppm
H-389A	G,13,17	0.0025	6.02	700 ppm
H-403A	G,15,22	0.021	5.82	1.97
H-403B	G,15,22	0.075	1.45	11.4
H-403C	G,15,22	0.012	5.40	2.30
H-445	G,13,20	0.0012	6.85	270 ppm
T-641	G,11,34	0.034	5.16	6.26
H-906	G,15,35	0.035	0.77	2.70
T-1206	G,16,24	0.003	7.62	1730 ppm
T-246A	S,7,19	0.001%	0.50	0.039

*G – Grattan Township
S – Sebastopol Township

Locations are given on Figure 5 and Figure 2.

Non-Metallic Mineralization

APATITE

Apatite occurs in both Grattan and Sebastopol Townships in the form of veins and disseminated deposits, in pyroxene-rich dikes (map-unit 7b), syenite pegmatite (map-unit 8b) calcite patches, quartz monzonite (map-unit 6a,b) and in calc-silicate gneiss (map-unit 2b).

The apatite is found in the following mineralogical associations:

apatite-calcite, apatite-calcite-sphene-scapolite,
apatite-sphene-scapolite-plagioclase,
apatite-sphene-amphibole-calcite,
apatite-orthoclase-pyroxene-amphibole-calcite,

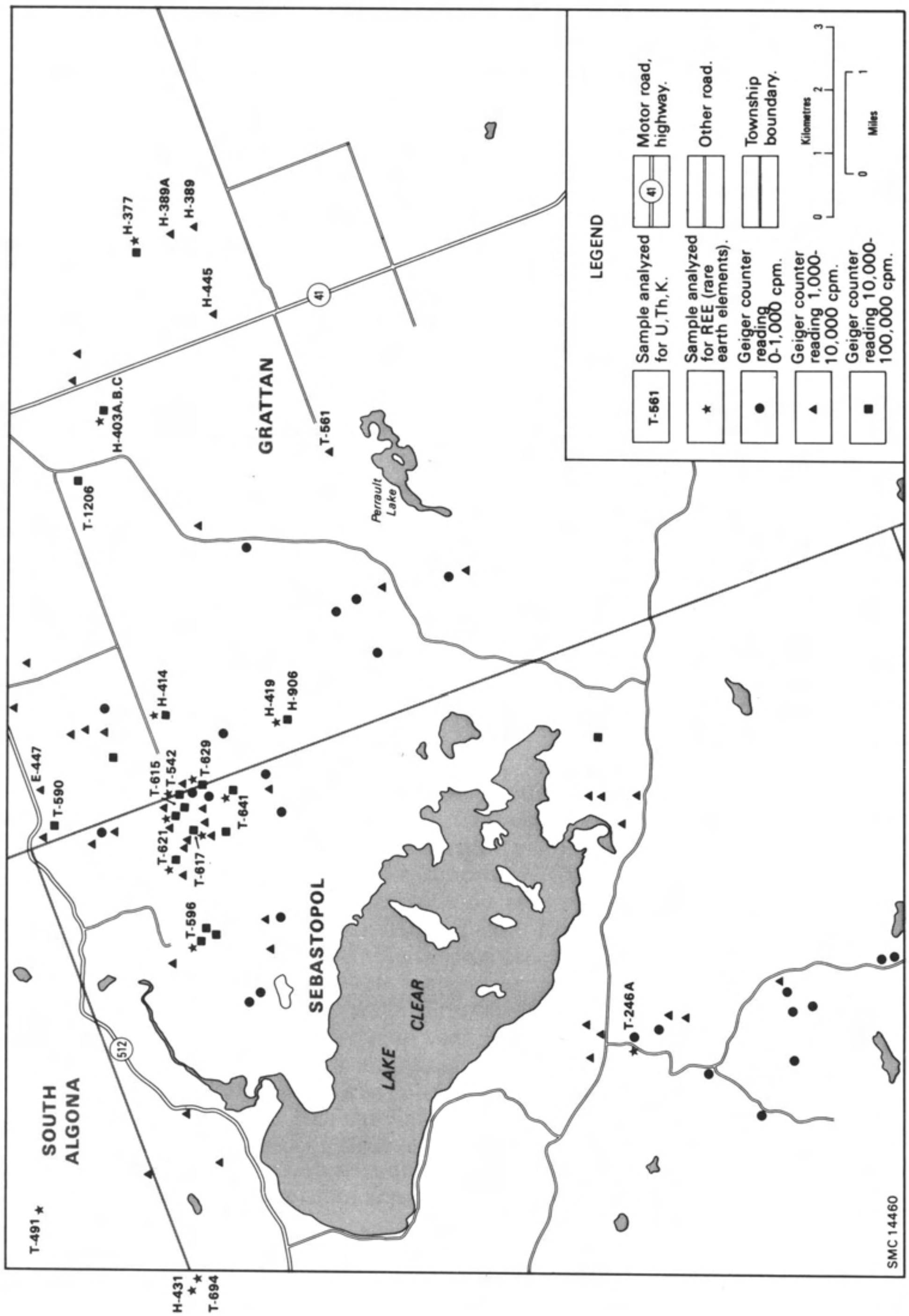

Figure 5–Geiger counter readings and location of samples analysed for U, Th, K and rare earth elements in the Clontarf area. See Tables 8 and 9 for analyses.

TABLE 9 RARE EARTH ELEMENT ABUNDANCES (PPM) BY SPECTROGRAPHIC AND X-RAY FLUORESCENCE ANALYSIS (BY GEOSCIENCE LABORATORIES, ONTARIO GEOLOGICAL SURVEY).

	T-491	H-419	T-694	H-431	T-246	H-414	T-596	T-615	T-617	T-621	T-629	H-403A	H-403B	T-641	T-542A	H-377
Ce	85	174	49	103	160	420	530	50	1310	310	950	110	320	160	370	160
La					<100	300	800	300	1500	300	1000	<100	350	150	500	100
Nd					<100	300	600	150	1500	250	700	<100	350	200	500	<100
Ta					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sc					10	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	10

SAMPLES (For Locations, see Figure 5).

T-491 — Syenite
H-419 — Syenite.
T-694 — Hydronephelite-bearing syenite pegmatite.
H-431 — Nepheline syenite pegmatite.
T-246 — Pyroxenite dike.
H-414 — Albite quartz monzonite.
T-596 — Albite quartz monzonite.
T-615 — Albite quartz monzonite.
T-617 — Albite quartz monzonite.
T-621 — Albite quartz monzonite.
T-629 — Albite quartz monzonite.
H-403A— Albite quartz monzonite.
H-403B— Albite quartz monzonite.
T-641 — Albite quartz monzonite.
T-542A— Albite quartz monzonite.
H-377 — Granite pegmatite.

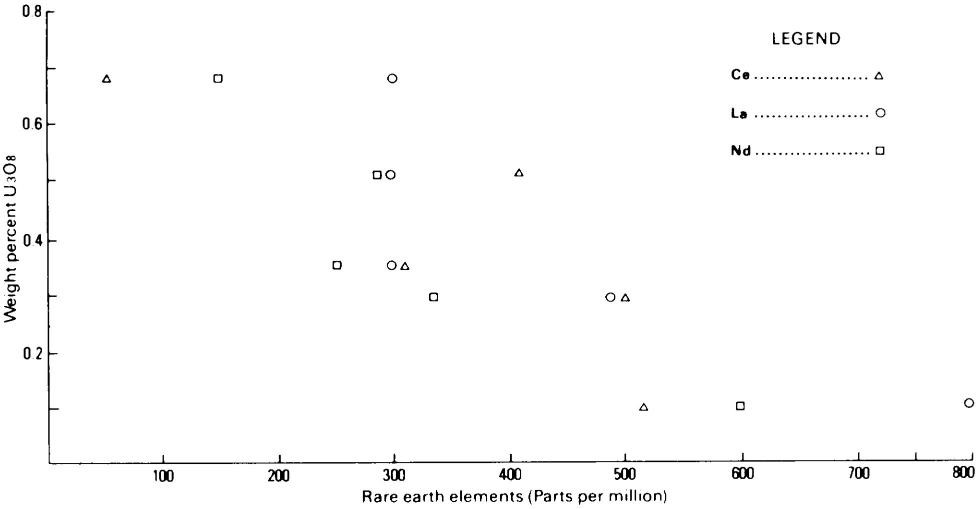

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Figure 6–Relationship between U_3O_8 content and rare earth element content in samples from northern Sebastopol and Grattan Townships.

apatite-mica-sphene-pyroxene-plagioclase-calcite,
apatite-orthoclase-quartz-pyroxene, and
apatite-pyroxene-mica.

Where extraction of apatite has been recorded it was from syenite pegmatite, or calcite veins which cut the metasediments or quartz monzonite. The apatite in the calcite veins occurs as massive aggregates and as euhedral crystals. It is found in colours of green, yellow-green, brown, and red-brown. The size varies from a few millimetres to 48 cm long and 1 mm to 10 cm wide.

Several small non-recorded apatite workings and showings were observed by the writer in the summer of 1977 in Sebastopol Township. (1) On lot 20, concession XIII, a small pit 3 by 3 m and 0.6 m deep was found in a calcite vein within syenite (map-unit 5c). (2) On lot 31, concession XII, about 1.6 km southeast of Highway 512 a small trench within a calcite vein was found and 450 m to the southeast of this trench several veins of apatite up to 0.6 m wide within quartz monzonite were located. (3) On lot 32, concession XIII, about 1.3 km south of Highway 512, a very rough road from the bush road leads eastwards to an apatite showing, a distance of 300 m. A 1 m massive apatite zone occurs within quartz monzonite. Present also are quartz-pyroxene veins and calcite veins. (4) On lot 18, concession IX, one small pit and one trench were examined, exposing a 1 m wide calcite vein cutting quartz monzonite and containing euhedral apatite crystals.

The above occurrences 2 and 3, together with properties 5 and 6, form an apatite rich zone, traced intermittently for about 2.7 km by the author, trending north to northwest and subparallel to a bush road leading to the Smart mine. The width of this zone was not possible to determine from surface examinations.

FELDSPAR

Several granite pegmatite dikes cross-cutting metasediments occur throughout the map-area. Feldspar was produced from a pink graphic pegmatite granite on lot 22, concession VIII, Grattan Township, by G. Colautti for a short time, but closed because of the high percentage of quartz and other impurities within the microcline (Satterly 1945). The mineralogy of the dikes is hornblende-tourmaline-plagioclase-perthite-microcline-quartz. Tourmaline intergrowths and euhedral crystals are present. These dikes are also characterized by anomalous high radioactivity readings. Several small workings of feldspar were found in Sebastopol Township in lot 32, concession XII and minor amazonite was observed 300 m southeast of the Smart deposit. Feldspar was located 1 km north of the northeast shore of Lake Clear during the field season in the syenite pegmatites which are coarse grained and have minor or no impurities.

MICA

Six small completely overgrown pits were found by the field party in 1977, on lot 34, concessions XI and XII, Sebastopol Township. These pits were located within small irregular bodies of pyroxene-rich granofels often associated with minor calcite, and large pods of phlogopite. The phlogopite has been removed from these pits and small amounts of it lie loose around them. Some of the phlogopite books measure 46 cm in diameter. The pyroxene hornfels is found as small screens within pink albite quartz monzonite.

NEPHELINE

The mineral nepheline, $NaAlSiO_4$, is the characteristic feldspathoid of the nepheline syenite pegmatite and nepheline syenite gneiss found in South Algona and Sebastopol Townships respectively. The nepheline syenite pegmatite zone of South Algona Township (Figure 7) extends for a strike length of about 3 km and has a maximum width of about 0.3 km. This zone contains 25 to 30 percent nepheline syenite bodies which contain on the average 30 to 40 percent nepheline; other minerals present are albite, biotite and magnetite and in few places sodalite. The iron-bearing minerals (magnetite, biotite) constitute up to 6 percent of the rock. The nepheline is creamy white in colour and in a few places is pink; crystals vary in size from a few centimetres to 20-30 cm, embedded in an albite matrix (see Photo 10).

A layer about 20 m thick of nepheline syenite gneiss occurs in Sebastopol Township on lot 25, concession IV, about 2.2 km south-southeast of Mud Lake. The strike length is unknown due to lack of exposure. This layer is characterized by 20 percent elongated nepheline. The mineralogy of this gneiss is biotite-magnetite-nepheline-plagioclase. The biotite and magnetite constitute up to 4 percent of the rock.

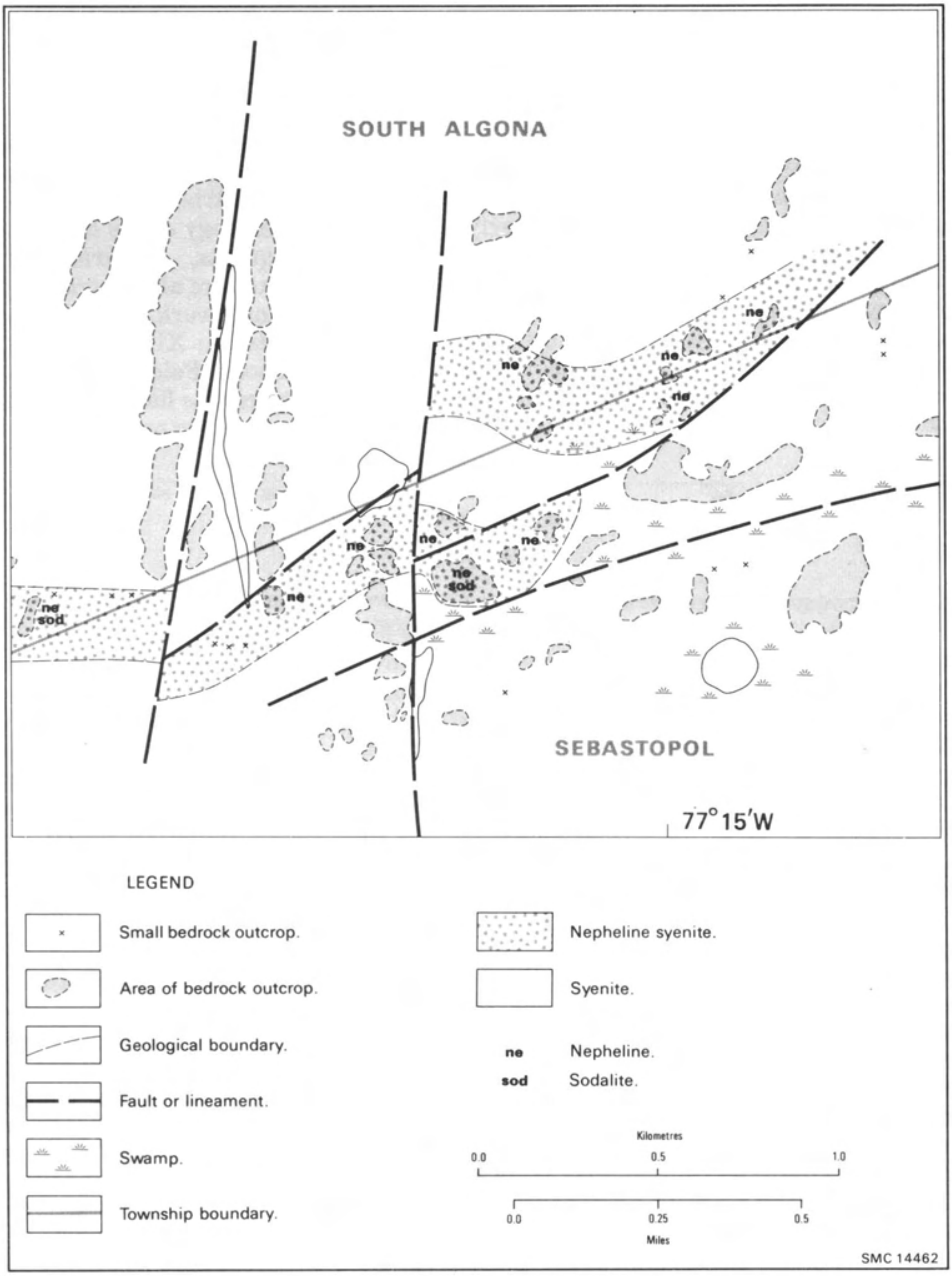

Figure 7–The South Algona-Sebastopol Townships nepheline syenite zone, southwest of Eganville. Note that the area west of Longitude 77°15′ is outside the map-area.

SAND AND GRAVEL

Sand and gravel deposits in the form of kames, raised beaches and terraces, are present in the area. These deposits are small and are used for local construction, mainly for maintaining gravel surfaced township roads. There are no large sand and gravel deposits known which might serve areas outside of the map-area.

STONE

Ordovician limestone occurs in several places within the map-area. The biggest body is found in the northeast corner of the map-area, and is the only one which was extensively quarried, intermittently from 1925 to 1960 (Satterly 1945; Hewitt 1960; Hewitt and Voss 1972). This limestone was assigned stratigraphically to the Rockland Formation by Kay (1942), and is grey in colour and flat lying.

Description of Properties and Occurrences

DICK MOLYBDENITE OCCURRENCE (1)*

In 1977 William G. Dick held patented land enclosing a small deposit of molybdenite located in lot 11, concession XI, Grattan Township, about 400 m south-southeast of the farm houses. In 1918 some development work was carried out in the northern part of the lot (Satterly 1945). This work consisted of the exploration of five small pits, up to 5 m in length and 1.5 m in depth, over a strike length of 85 m. A band of friable biotite-hornblende-plagioclase gneiss (map-unit 2a) occurring within meta-arenite is veined by granite pegmatite dikes (map-unit 8a) and quartz veins. The metasediments are folded with the fold axis plunging shallowly to the west, and the gneissosity shallowly dipping to the northwest and southwest. The mineralization is associated with the granite pegmatite which is cutting the metasediments and contains quartz veins and is slightly mineralized with scattered flakes of molybdenite usually accompanied by pyrite. The mineralization changes from minor disseminations in the eastern pit to brecciated massive sulphides (see Structural Geology) of up to 30 percent in the western pit within the biotite-hornblende-plagioclase gneiss. A high grade sample taken from the western pit by the writer and analyzed by the Geoscience Laboratories, Ontario Geological Survey, assayed 2.4 percent molybdenum, 0.29 percent copper, 0.01 ounces gold per ton, trace silver and 35.4 percent sulphur (see Table 7).

*Number in parentheses refers to property number shown on Map 2433 (back pocket).

HALL OCCURRENCE (COLAUTTI FELDSPAR QUARRY) (2)

In 1977 W. Hall (Eganville) held patented land enclosing a former feldspar quarry which is located in the southern half of lot 22, concession VIII, Grattan Township. It was operated in late 1942 by G. Colautti, of Barrys Bay. The land was formerly owned by L. St. Louis (Satterly 1945).

There are four pits, from which a total of 1,174 tons of feldspar was produced in 1943; one is an open cut 20 by 5 m and 2.5 m deep; two are 10 by 3 m and 2 m deep; and the last one is 6 by 6 m and 2-2.5 m deep. These workings exposed a pink graphic granite pegmatite; very minor microcline is locally free of quartz. Quartz-tourmaline intergrowths are common. No other work is known to have been done on this property since 1943.

LARMOND OCCURRENCE (RADNOR IRON MINE) (3)

Currently P.D. Larmond owns three patented lots: 16 and half of 17 in concessions IX and X enclosing the former Canada Iron Furnace Company's Radnor mine located in lot 16, concession IX, Grattan Township. An iron deposit is exposed on surface 230 m to the north of the southern boundary of lot 16. A wagon road links the former mine with the Canadian National Railway at Caldwell Station. No work has been done on the property by P. Larmond. This property was owned and developed between 1900 and 1907 by Canada Iron Furnace Company. In 1901 and 1904 some drilling was done by the same company (Carter 1903, p.114; Corkill 1905, p.77). From 1901 up to 1907 seven pits were operated and 18,824 tons of ore were shipped to Radnor Forges, Quebec. An average analysis of the ore which was shipped yielded 47.50 percent Fe, 19.50 percent SiO_2, and 0.25 percent sulphur (MacKenzie 1908). Ore which had Fe content below 30 percent was stockpiled at the minesite. These pits are distributed over a strike length of 1300 feet and were described from southeast to northwest, by Satterly (1945, p.60).

Pit	Description
A	100 by 25 feet and 25 feet deep.
B	165 by 35 feet and 30 feet to water level, with an inclined drift, which Mackenzie reports is 8 by 18 feet and 80 feet long. The magnetite band narrowed from 10 to 6 feet at the bottom. Above the drift opening there is some disseminated magnetite in stringers and bands parallel to the gneissic structure which dips 35 degrees S.W.
C	140 by 25 feet, with a 30-foot face on the southwest side and a 10-foot face on the northwest side. The water is 3 feet deep.
D	35 by 35 feet and 20 feet deep.
E	30 by 20 feet and 15 feet deep.
F	200 by 10 to 25 feet and from 20 to 30 feet deep.
G	340 by 15 to 40 feet and 40 feet deep.

In 1950 the property was owned by Joe Larmond of Hyndford, Renfrew County. Algoma Ore Properties Limited, of Sault Ste. Marie, Ontario, optioned the property and in addition also held three lots: lots 16, 17 in concession VIII, and lot 16, in concession X (Figure 8). They conducted geological and magnetic

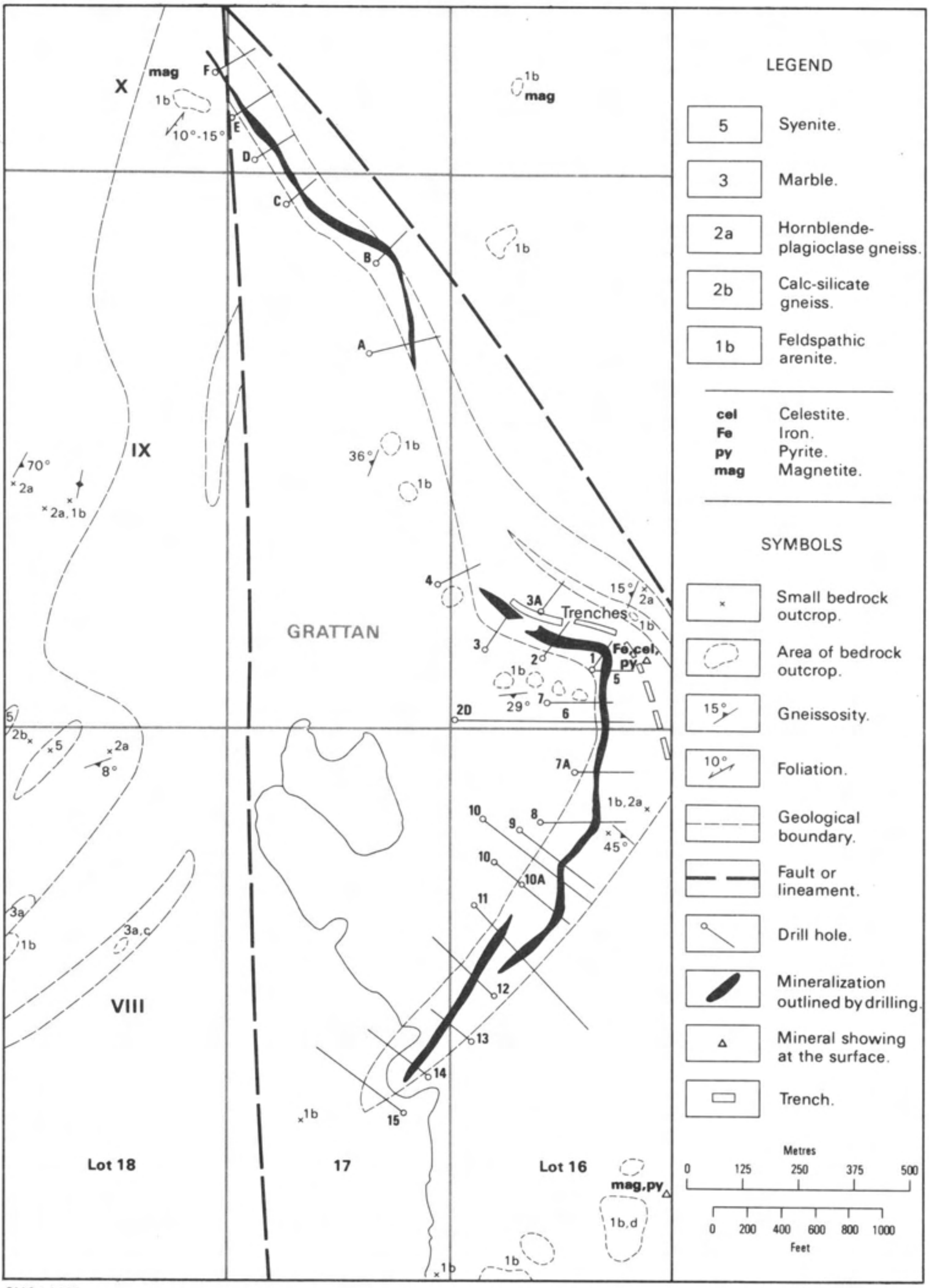

Figure 8–Geological sketch map of the Larmond iron occurrence (Radnor mine). Modified from plans of Algoma Ore Properties Limited.

surveys and diamond drilling (10,720 feet in 26 holes, Gilbert 1951) From the 26 drill holes (Figure 8) they outlined an iron deposit with an overall length of about 3,900 feet, and an average width of 29.2 feet, and extending to a depth of 600 feet. Tonnage estimates by diamond drilling reported by the company are: a) proven 3,639,600 tons giving 1,272,587 tons of concentrate; b) indicated 9,099,000 tons giving 3,181,468 tons of concentrate (Gilbert 1951). The ore body as outlined by drilling and dip needle magnetic survey extends from lots 17, 16, concession VIII through lots 16, 17, concession IX to lot 17, concession X (Figure 8). The option on the property was subsequently dropped. Parts of that property are now owned by P. Larmond, M.J. Power of Eganville, who holds lot 18, concession X, Northern Consolidated Exploration Limited which holds half of lot 17, concession X, D. Warren of Eganville who holds half of lot 17, concession IX and Oswald Donahue who holds lot 17, concession VIII.

Geology

The iron deposit lies within a metasedimentary sequence of feldspathic arenite (map-unit 1b) and hornblende-plagioclase gneiss (map-unit 2a). The geology of this deposit was described by Rose (1958, p. 49-50).

> At the mine a long sinuous band of grey hornblende-feldspar gneiss is included within the pink gneissic granite. The gneiss and the granite are cut by pegmatitic granite and coarse syenite dykes some of which are 25 feet wide.... Magnetite occurs mainly in the grey gneiss as disseminations, stringers and bands that in places are of ore grade. Small clots and crystals of magnetite also occur in the pegmatitic dykes that cut the magnetite bearing zone.
>
> Such dykes have a high proportion of pink feldspars (microcline and orthoclase) and the colour of these fades to a greenish grey in a narrow zone adjacent to the intruded magnetite-bearing gneiss.
>
> The pink granite consists mainly of quartz, microcline, plagioclase, perthitic plagioclase, and minor green hornblende with some accessory sphene, magnetite, and in places some pyrite, in part altered to hematite. Perthitic plagioclase in ragged crystals is more abundant in the grey-green contact zone of the granite than in the pink granite. The grey gneiss characteristically contains much dark green hornblende, pyroxene, plagioclase, magnetite, crystals and rounded grains of sphene, flakes of biotite, carbonates, chlorite, and rarely some tiny rusty veinlets of epidote.

The pink gneissic granite described by Rose is metamorphosed feldspathic arenite (map-unit 1b). In addition to the pegmatitic granite and syenite dikes there are also anorthositic dikes greyish in colour. These dikes cross-cut the metasediments and the magnetite bands and lenses. The coarse-grained euhedral to subhedral magnetite mineralization occurs in narrow lenses and bands up to 8 m thick. The ore-grade mineralization is found in an arenite zone, marked by the trenches in Figure 8, which is exposed for a strike length of 400 m and 12 m in width. This mineralization is structurally controlled. The bands and lenses of magnetite are conformable with the gneissosity in the arenite and hornblende-plagioclase gneiss. The gneissosity strikes east to southeast and varies in dip from 25 to 45 degrees south and west with steeper dips toward the south end of the deposit. The metasedimentary sequence is gently folded and the fold axis plunges at 30 degrees and trends S23W. Shearing was also observed in the northern part of the deposit, and is characterized by non-coherent hornblende-plagioclase gneiss containing lenses of unsheared rock; fractures striking east and dipping vertically were observed in a syenite pegmatite dike and in some cases pink celestite was developed in these fractures.

OPEONGO URANIUM OCCURRENCE (4)

Opeongo Mines Limited held, in 1955, 840 patented and 50 staked acres on lots 19 and 20, in concessions VII, VIII, IX and X and the west half of lot 21, concessions VII, VIII, and IX, in Sebastopol Township (Macdonald 1955). The former property location is immediately to the south of Lake Clear. In 1955 about 20 shallow diamond drill holes were drilled and minor trenching was carried out in lot 20, concession VII, north of Opeongo Road.

Uranium mineralization occurs in two pyroxene-rich veins within gneissic quartz monzonite (map-unit 6a). The quartz monzonite is cross cut by minor granite and pyroxene rich pegmatite dikes; quartz veins are also present.

The major trench is 15 by 3 m and 2 m deep, trends north-northwest and was excavated in pyroxene-rich dikes. These dikes are coarse grained and irregular in shape and consist of quartz, orthoclase, apatite, and pyroxene. They are exposed over a length of 6 m and a width of less than 30 cm. A selected sample from this trench taken by the author was analysed by the Geoscience Laboratories, Ontario Geological Survey, and assayed 0.015 percent U_3O_8 and 0.17 percent Th (see Table 8). The 50 staked acres were allowed to lapse.

PLATT, E. (MEANY APATITE MINE) (5)

The property owned by Edmond Platt is located in Sebastopol Township, lot 31, concession X about 3.5 km south-southeast of Highway 512. The property, formerly known as the Meany mine, was opened in 1880 (Willmot 1885; Satterly 1945) and operated till 1883. Three hundred tons of apatite were mined, from a pit 7 m in depth, 2 m wide and 30 to 40 m long, that was sunk in a vein of pyroxene, apatite and feldspar. The vein is intersected by small pink to orange calcite veinlets. The apatite occurs as massive aggregates cross-cut by the pink calcite veins. The mineralogy of this deposit is calcite, titanite, hornblende, pyroxene, apatite and feldspar. No work has been reported on this property since that time.

SMART OCCURRENCE (SMART APATITE MINE) (6)

The Smart mine was opened prior to 1880 (Willmot 1885; Satterly 1945). The deposit was owned at that time by Thomas Smart. The mine is located in lot 31, concession X, Sebastopol Township. It is reached by a bush (dirt) road which joins Highway 512 about 9.6 km southwest of Eganville, and is about 4 km south-southeast of the highway. A foot path from the bush road leads eastwards to the old mine site a distance of about 210 m.

The workings consist of a series of narrow cuts within an area about 90 m long. A major pit 5 m in depth, 1 to 1.5 m wide and 30 m long was sunk in part in a pyroxene-apatite-feldspar syenite dike and in part in a thin calcite vein with euhedral brown apatite crystals. No production tonnage information is available and the area is now open for staking.

Subsequent to that period no other work has been done on this deposit except some blasting by the National Museum of Canada, Ottawa, in the summer of 1977 for mineral collecting purposes.

SMITH, L. (ALGOMA ORE PROPERTIES LIMITED) (7)

Lyle Smith staked two claims in lot 16, concession VIII, Grattan Township, in the summer of 1977. No other work by Smith was submitted or known to have been done on the property. Previous work was done by Algoma Ore Properties Limited in 1950 and 1951 (see Larmond Occurrence).

TRACEY, M.E. (BONNECHERE LIME QUARRY) (8)

The former Bonnechere Quarry is located in Grattan Township, lot 8, concession XV and is currently owned by Mary E. Tracey. The Shane Lime and Charcoal Company Limited of Eganville owned the property in 1944 (Satterly 1945), and in 1960 it was operated by the Bonnechere Lime Company Limited (Hewitt 1960b). They produced lime which was mainly shipped to uranium mills at Bancroft (Hewitt 1960).

The quarry is located about 0.7 km westwards from the northeast corner of the map-area. It is about 270 by 120 m and 3 to 5 m deep. The quarry was operated intermittantly from some time before 1925 through 1960 (Satterly 1945; Hewitt 1960). When operations ceased is not known.

TURNERS ISLAND APATITE OCCURRENCE (9)

Apatite is located on Turners Island, in Lake Clear. The property was owned by Robert Turner in 1879. At various places on Turners Island, more than ten occurrences have been worked on a small scale for apatite. Apatite was mined first in 1879 and up to 1882, 200 tons were produced from an open cut (175 feet long, 3 to 15 feet wide and 2 to 12 feet deep) located in the northeastern part of the island where the largest workings are situated (Satterly 1945). Some of the mineralized dikes are exposed in the cliff which forms the north shore of the island.

The host rocks of the apatite veins and patches are variably syenitized calc-silicate gneiss, biotite gneiss, meta-arenite and scapolite skarn. The mineralization occurs in veins and dikes but also in pegmatitic patches with or without calcite cores. The mineralogy is apatite-zircon-titanite-scapolite-pyroxene-hornblende-microcline. The apatite occurs as massive aggregates and euhedral crystals, green to brown to red brown in colour.

In 1943, one of the old workings was explored for rare earth element minerals (Satterly 1945) No record exists as to who carried out this work. Since that time no other work has been done. Mineral collectors often visit the area for collecting purposes. The deposits are of mineralogical interest. The apatite does not appear to be present in commercial quantity.

Recommendations for Future Exploration

The scarcity of any recent prospecting throughout the map-area, despite the good accessibility, is attributed to the absence of any reliable detailed mapping.

From the data gathered during the 1977 field season, the writer would strongly advise that further prospecting, aided by detailed geophysical surveys is fully warranted for uranium, rare earths, gold and copper.

Uranium mineralization and rare earths were found by the field party in 1977, in several locations within or close to quartz monzonite which is in contact with clastic siliceous metasediments, especially where the granitic rocks have assimilated, metamorphosed and metasomatised sedimentary rocks.

From the many occurrences discovered in the summer of 1977 and their association, prospecting for uranium mineralization would seem to be best directed to the contact of the plutonic rocks (mostly quartz monzonite or syenite) with pink feldspathic arenite (map-unit 1b). The plutonic rocks close to the contact are characterized by minor marble patches, pyroxene-rich rock with or without quartzite and granite pegmatite patches and dikes.

The best uranium mineralization is located on the boundary of Sebastopol and Grattan Townships, north of Lake Clear. This area needs to be examined for possible low grade, large tonnage disseminated mineralization.

A few occurences of thin massive pyrite-pyrrhotite have been found within marble, metagabbro, gneissic syenite and hornblende-plagioclase gneiss. The latter two are characterized by low-grade copper mineralization but because they are located within the uranium-rare earth favourable zone, more prospecting should be done. The best results for gold-copper-zinc-nickel were obtained from the massive sulphide mineralization of the metagabbro body on MacDonalds Mountain.

Minor concentrations of magnetite are found in many of the rock types in the area, but the Grattan Township iron formation is presently the only deposit which might be of future economic potential.

Nepheline and feldspar are industrial minerals of possible economic potential in the area. The nepheline syenite zone of South Algona Township might be of future economic interest. Any prospecting for nepheline should also be directed west of the map-area and north of the boundary between Sebastopol and South Algona Townships.

Feldspar of possible commercial quality and quantity is present west-northwest of Little Lake Clear.

Rocks and Minerals for the Collector

A variety of rocks and minerals are present in the map-area which are of interest to mineral collectors. Some of the excellent minerals recovered in the course of small scale mining for apatite in the Sebastopol Township have found their way into major mineral collections of the world. Such crystals are: apatite, zircon, titanite, pyroxene, scapolite, hornblende and microcline, other minerals include amazonite, biotite, phlogopite, tourmaline, nepheline, purple hydronephelite, diopside, pyrite, molybdenite and radioactive minerals (thorite).

All of the minerals listed above occur as well-formed crystals, mostly in calcite veins. Localities for these specimens are Smart mine, Meany mine, Turners Island, 0.3 km west of Clontarf on Opeongo Road, and lot 17, concession XIV (nepheline and hydronephelite), all located in Sebastopol Township.

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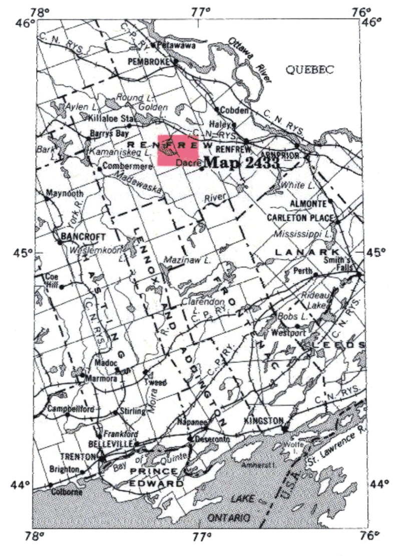
INDEX

Ministry of Natural Resources
Ontario
Hon. James A. C. Auld
Minister
Dr. J. K. Reynolds
Deputy Minister

Ontario Geological Survey
Map 2433
Clontarf



Scale 1 inch to 50 miles

N.T.S. Reference 31F/6

SYMBOLS

- Glacial striae.
- Small bedrock outcrop.
- Area of bedrock outcrop.
- Bedding, top unknown: (inclined, vertical).
- Gneissosity, (horizontal, inclined, vertical).
- Foliation; (horizontal, inclined, vertical).
- Lineation with plunge.
- Geological boundary, observed.
- Geological boundary, position interpreted.
- Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.
- Jointing; (horizontal, inclined, vertical).
- Drag folds with plunge.
- RA Radioactivity.
- Swamp.
- Motor road. Provincial highway number encircled where applicable.
- Other road.
- Trail, portage, winter road.
- Township boundary, approximate position only.
- Mining property, surveyed. Boundary approximate position only.
- Mineral deposit; mining property, unsurveyed.
- Surveyed line, approximate position only.

PROPERTIES, MINERAL DEPOSITS

1. Dick occurrence.
2. Hall occurrence (Colautti quarry).
3. Larmond occurrence (Radnor mine).
4. Opeongo occurrence.
5. Platt, E. (Meany mine).
6. Smart occurrence.
7. Smith, L.
8. Tracey, M. E. (Bonnechere quarry).
9. Turners Island occurrence.

Information current to December 31, 1977. For further information see report.

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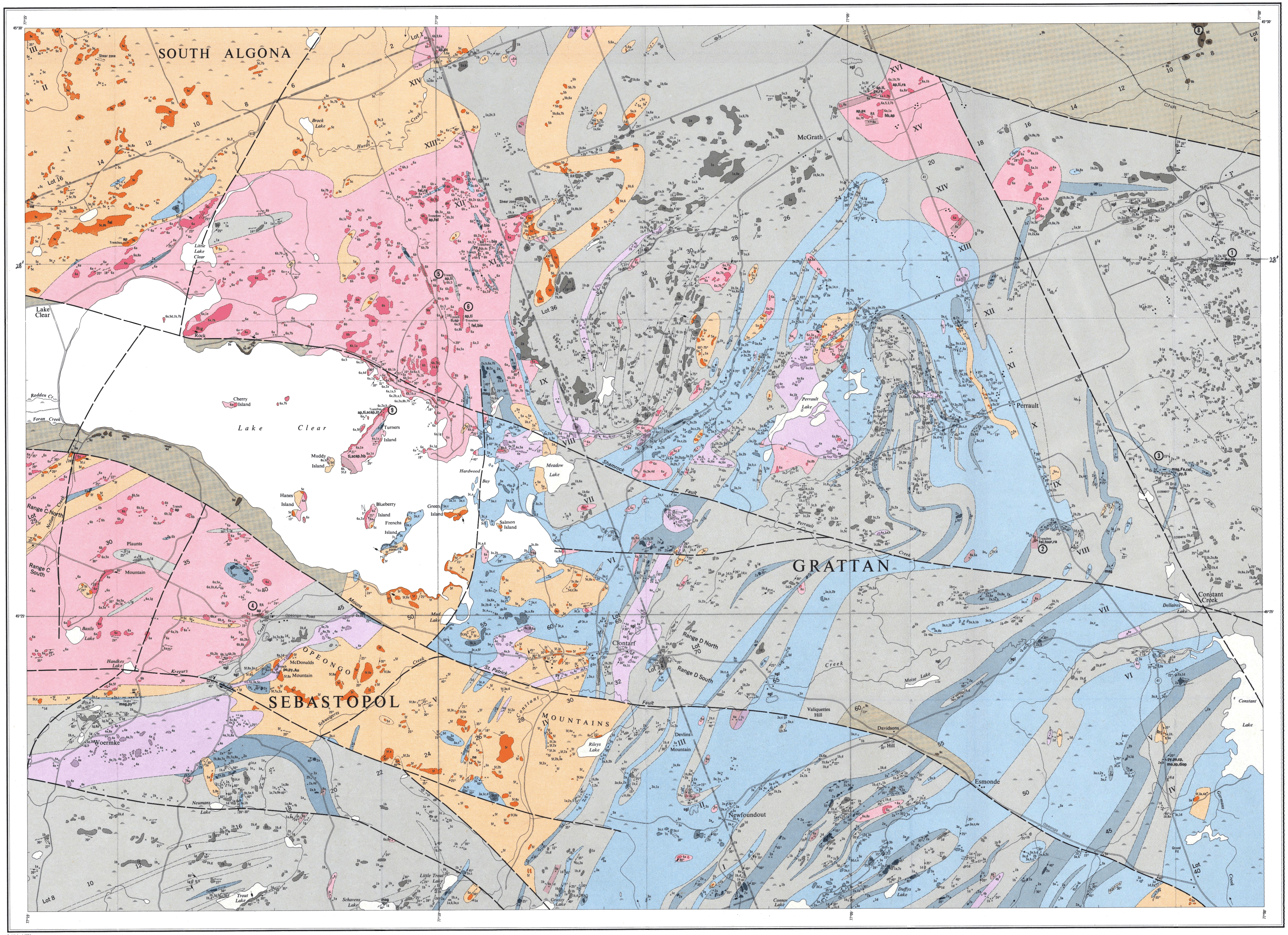
Geological Survey of Canada map 1046A.

Preliminary map (O.G.S.) P1560, Clontarf Area, scale 1:15 840, 1978.

Cartography by G. R. Baker and assistants, Surveys and Mapping Branch 1979.

Base map derived from maps of Forest Resources Inventory, Surveys and Mapping Branch.

Magnetic declination in the area was approximately 10° 10'W, 1976.



LEGEND

CENOZOIC[a]

QUATERNARY

PLEISTOCENE AND RECENT

Glacial and glaciofluvial deposits, swamp and stream deposits.

UNCONFORMITY

PALEOZOIC[b]

ORDOVICIAN

9e *Brown to black fossiliferous shale with calcareous cement.*
9d *Silty fossiliferous limestone interbedded with thin shaly layers and containing turbidite deposits.*
9c *Dark grey slaty limestone with shaly interbeds.*
9b *Grey-buff, fossiliferous limestone.*
9a *Limestone.*

UNCONFORMITY

PRECAMBRIAN[b]

LATE PRECAMBRIAN

UNMETAMORPHOSED PLUTONIC ROCKS

FELSIC AND ALKALIC INTRUSIVE ROCKS

8a *Granite pegmatite dikes.*
8b *Syenite pegmatite dikes.*

MAFIC INTRUSIVE ROCKS

7a *Diorite dikes.*[c]
7b *Pyroxenite.*
7c *Diabase dikes.*
7d *Hornblendite dikes.*

INTRUSIVE CONTACT

METAMORPHOSED PLUTONIC ROCKS

FELSIC INTRUSIVE ROCKS

6 *Unsubdivided.*
6a *Gneissic, leucocratic quartz monzonite.*[d]
6b *Massive to foliated, leucocratic quartz monzonite.*[e]

INTRUSIVE CONTACT

ALKALIC INTRUSIVE ROCKS

5 *Unsubdivided.*
5a *Massive to gneissic pink potassic syenite.*
5b *Gneissic pink hornblende-biotite syenite.*
5c *Massive to weakly gneissic, pink pyroxene-amphibole syenite.*
5d *Gneissic, grey-white nepheline syenite.*
5e *Massive, porphyritic nepheline syenite.*
5f *Lineated amphibole-biotite syenite.*

INTRUSIVE CONTACT

MAFIC INTRUSIVE ROCKS

4a *Gneissic quartz diorite.*
4b *Foliated, medium to coarse grained gabbro.*
4c *Massive, coarse grained, porphyritic gabbro.*
4d *Massive, fine to medium grained gabbro.*
4e *Massive, coarse-grained, quartz-poor gabbro.*

INTRUSIVE CONTACT

METASEDIMENTS[f,g]

CARBONATE METASEDIMENTS

3 *Unsubdivided.*
3a *Massive, calcitic marble (10 to 30% diopside and phlogopite).*[h]
3b *Gneissic calcitic marble (with phlogopite and diopside).*
3c *Marble tectonic breccia.*
3d *Massive dolomitic marble.*[h]
3e *Ferruginous calcareous siltstone (40 to 50% pyrite).*

CALCAREOUS METASEDIMENTS

2a *Amphibole-quartz-plagioclase gneiss.*
2b *Calc-silicate gneiss (calcite-amphibole-diopside-plagioclase).*
2c *Diopside-rich granofels intercalated with thin quartzarenite layers (local mica-rich segregations).*
2d *Hornblende-magnetite ironstone.*

CLASTIC SILICEOUS METASEDIMENTS

1a *Migmatitic biotite-quartz-potassic feldspar gneiss (feldspathic arenite).*
1b *Foliated feldspathic arenite (1 to 5% biotite and magnetite).*
1c *Quartzose arenite (biotite-quartz-plagioclase gneiss; biotite >10%).*
1d *Feldspathic arenite intercalated with quartzose arenite.*
1e *Massive quartzarenite.*
1g *Migmatitic garnet-biotite-quartz-plagioclase gneiss (wacke).*

ap	Apatite	po	Pyrrhotite
Au	Gold	py	Pyrite
bio	Biotite	px	Pyroxene
cel	Celestite	ra	Radioactive minerals
cp	Chalcopyrite	S	Sulphur
diop	Diopside	scap	Scapolite
Fe	Iron	sgl	Sand and gravel
fel	Feldspar	st	Stone
hb	Hornblende	ti	Titanite
mag	Magnetite	tour	Tourmaline
mo	Molybdenite	zr	Zircon
ne	Nepheline		

Ontario Geological Survey
Map 2433

CLONTARF

RENFREW COUNTY

Scale 1:31,680 or 1 Inch to ½ Mile

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

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

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

[c] *In places intrudes 4d and 4e.*

[d] *Locally contains up to 10% 2a, 1a and 8a, 8b.*

[e] *Locally contains up to 25% 1b, 8a and 8b.*

[f] *Rocks in these groups are subdivided lithologically and the order does not imply age relationship within or among groups.*

[g] *The components of metamorphic rocks are listed in order of increasing abundance.*

[h] *Contains quartz, calcite and locally graphite and diopside.*