PETROGRAPHY AND GEOLOGY

OF THE

BELMONT LAKE CONGLOMERATE

BELMONT TOWNSHIP, ONTARIO

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By

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SCOPE AND CONTENTS:

The Belmont Lake conglomerate belonging to the Grenville Supergoup in southeastern Ontario was studied. The conglomerate is interbedded with graded siltstones, mudstones, sandstones, and carbonates, and is associated with what are possibly island arc volcanic cycles.

Petrographic study has shown the conglomerate contains tuffaceous, intermediate volcanic, and a variety of sedimentary clasts. In addition both field and petrographic studies show that the conglomerate was derived from a local source -- most likely from the top of the third volcanic cycle and its associated sediments.

The depositional environment of the conglomerate is

presently unclear, but the overall stratigraphic context of the conglomerate seems to indicate a shallow water environment.

BELMONT LAKE

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CHAPTER ONE

INTRODUCTION

Location and Accessibility.

The study area is situated 5 km north-east of Havelock, Ontario on Belmont Lake (Fig.1). The lake is accessible by driving east on Highway #7; then following county road 48 north and east to Belmont Marina. The Belmont Lake conglomerate and associated clastics outcrop predominantly on the islands and along the eastern shore of the lake and the exposures are easily accessible by boat from the Marina.

Statement of the Problem.

During the summer and early fall of 1980, while assisting in the mapping of Belmont-Southern Methuen Townships for the Ontario Geological Survey, the author spent several weeks mapping the islands of Belmont Lake. Outcrop was studied on Long, Mary's, Raft, Sidonia, and Birch Islands, with special emphasis on Sidonia and Birch. Because an earlier designation of this conglomerate by Miller and Knight (1914) as the Hastings conglomerate is unsuitable, the conglomerate on the islands has been renamed Belmont Lake conglomerate for this study.

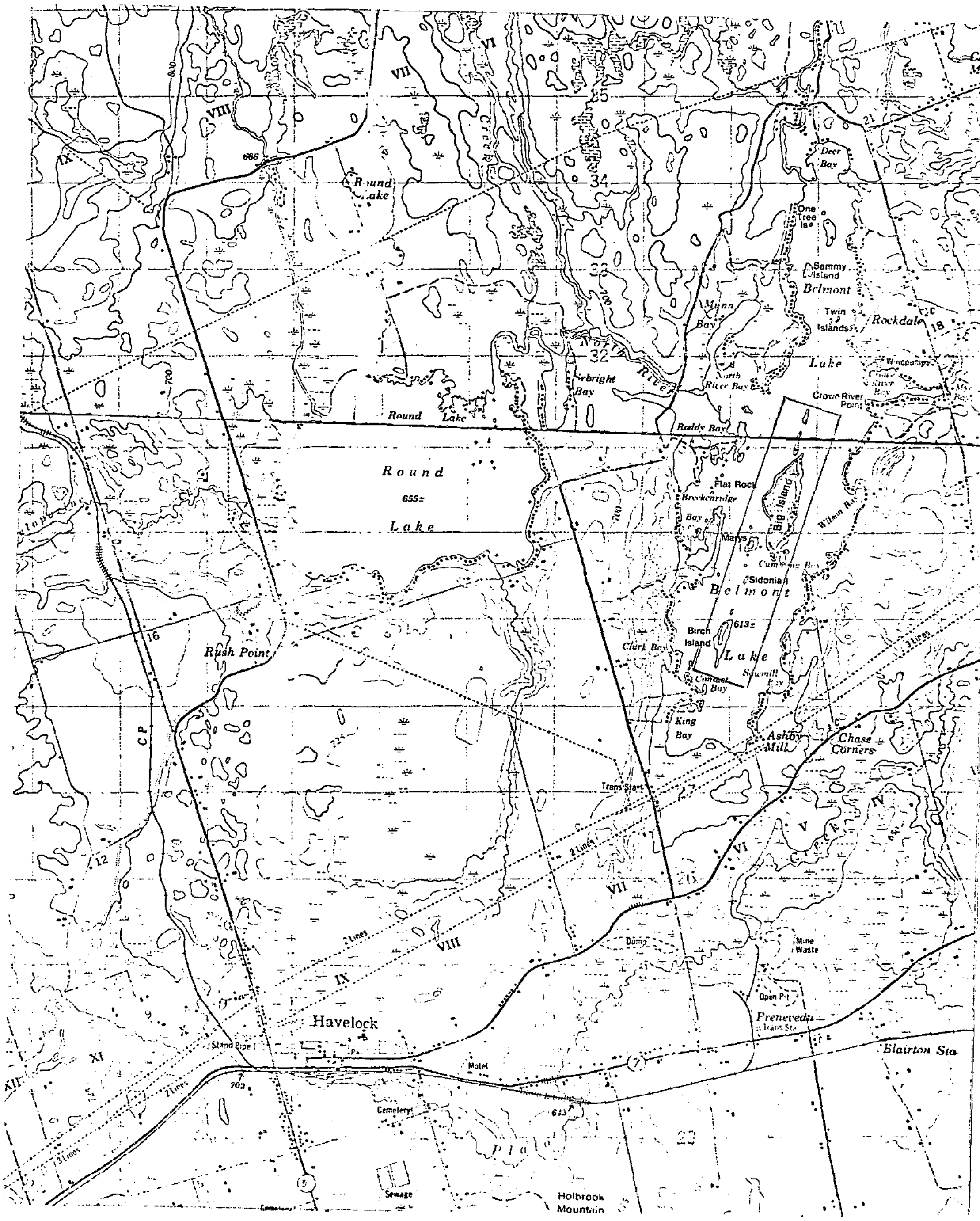


Fig. 1. Location Map.

The purpose of this study was to produce a detailed map of the conglomerate and to conduct a petrological study of the clasts in order to aid in their classification and in determining provenance and stratigraphic position of the conglomerate.

Previous Work.

The Belmont-South Methuen Township area was previously mapped in the mid 1800's by Mr. Murrary of the Geological Survey of Canada. He described conglomerates "associated with slates, and forming several islands running with the strike on Belmont Lake" (Vennor, 1870). In 1907, the Belmont-Methuen area was mapped by Willet G. Miller and Cyril W. Knight.

In their report of 1914, Miller and Knight included the conglomerate on Belmont Lake as a member of the Hastings series along with quartzite, greywacke, slate and limestone, and thus named it the Hastings conglomerate. The Hastings conglomerate was found to contain rounded, water worn quartz porphyry, feldspar porphyry, granite porphyry, felsite, greenstone, grey greenish grey schist, crystalline limestone, fine and coarse grained chert, jaspilyte, white quartz and eozoon fragment clasts. The eozoon fragment clasts were believed to be derived from eozoon canadense -- a Precambrian fossil of unknown origin present in the Grenville limestone.

Associated with the Hastings conglomerate are quartzite and greywacke but Miller and Knight do not make a clear distinction in all outcrops between the two lithologies. In their report, they also note the presence of interbedded conglomerate and slate on Big Island and on the east shore of Belmont Lake, 100 yards south of Crow River point and state that "this interbedding of coarse boulder conglomerate (on Crowe River point) and slate shows that conditions of deposition must have changed rapidly during Hastings time." Miller and Knight (1914) place the calcareous slates on the west shore of Birch Island in the Hastings series but note that "it is possible that they belong with the Grenville sediments."

The Hastings series was found to be a conformable one but deposited unconformably on the surface of the Keewatin series which Miller and Knight believed formed the basement, and the Grenville series which consisted of gneiss, mica schist, iron formation, quartzose dolomitic crystalline limestone, non-magnesian crystalline limestone and followed the Keewatin. They felt that the similarity of the "waterworn pebbles of crystalline limestone" in the conglomerate on Big and Sidonia Islands "to the underlying limestone" was proof of the unconformity. This was further supported by the "similarity of pebbles of red chert and jasper ... to the iron formation which occurs at the northwest corner of Belmont Lake.", and the fact that the

Hastings series was less metamorphosed than either the Keewatin or the Grenville series.

It is worth noting that there has been (and still is) some ambiguity over the stratigraphic position and classification of the conglomerate and associated clastics. Miller and Knight (1914) made a distinction between the Hastings series and the Grenville series but Burns (1951) later stated this distinction was meaningless. Wynne-Edwards (1972) had replaced Grenville series with Grenville group, and to allow for more than one lithologic assemblage in the Grenville group, the term Grenville supergroup was introduced (Moore & Thompson 1972).

CHAPTER TWO

GEOLOGICAL SETTING

Regional Geology of Belmont-Southern Methuen Townships.

As shown in Figure 2, the northern-central portion of the Belmont-Southern Methuen Townships lies within the central Meta-sedimentary Belt, -- a trough of supracrustal rocks flanked by other structural divisions of the Grenville province (Wynne-Edwards, 1972). The southern half of the map area is overlain by Paleozoic rocks. The dominant rocks in the northern-central portion are the metavolcanic rocks of the Grenville Supergoup (Fig.3) (Bartlett, 1980 pers. comm.). Bartlett, (1980 pers. comm.) assigned these metavolcanic rocks to five mafic to felsic volcanic cycles, three of which are distinct and complete in the area.

The base of each of the three complete and one of the incomplete volcanic cycles is represented by mafic pillowed and massive flows and lesser hyaloclastites. The mafic flows are commonly plagioclase phyric and amygdglodial. The thickness of the basal mafic flows for cycles I, II and III is estimated at 300-350 m, 500-700 m, and 3.5 km thick respectively. Each cycle has variations in the basal mafic flow unit but all three pass upward into

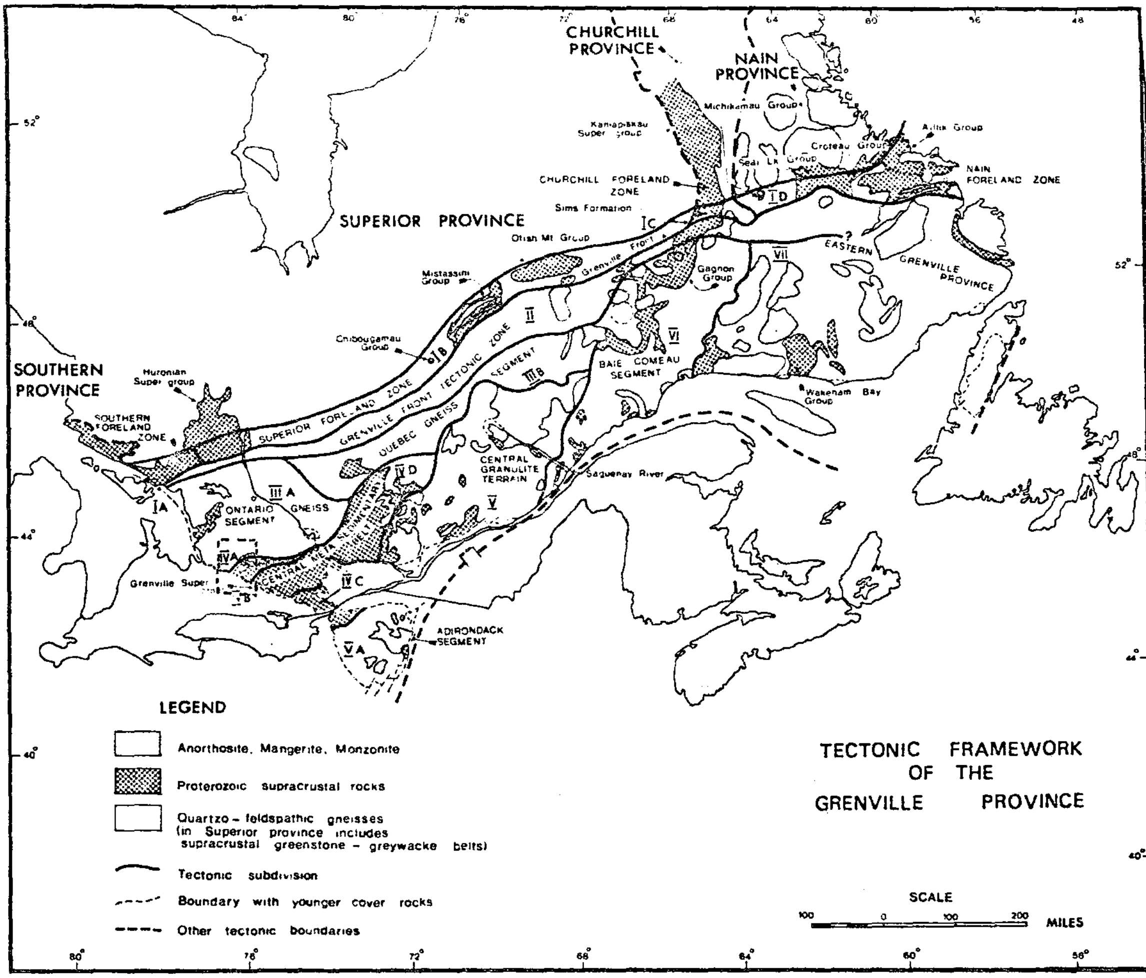


Figure 2. Location of the study within the Grenville Tectonic Province. (Wynne-Edwards, 1972)

FIG. 3 GENERAL GEOLOGY OF BELMONT TP

Ordovician Limestone

Metagabbro

Clastic Metasediments

Carbonate & Siliceous Carbonate Metasediments

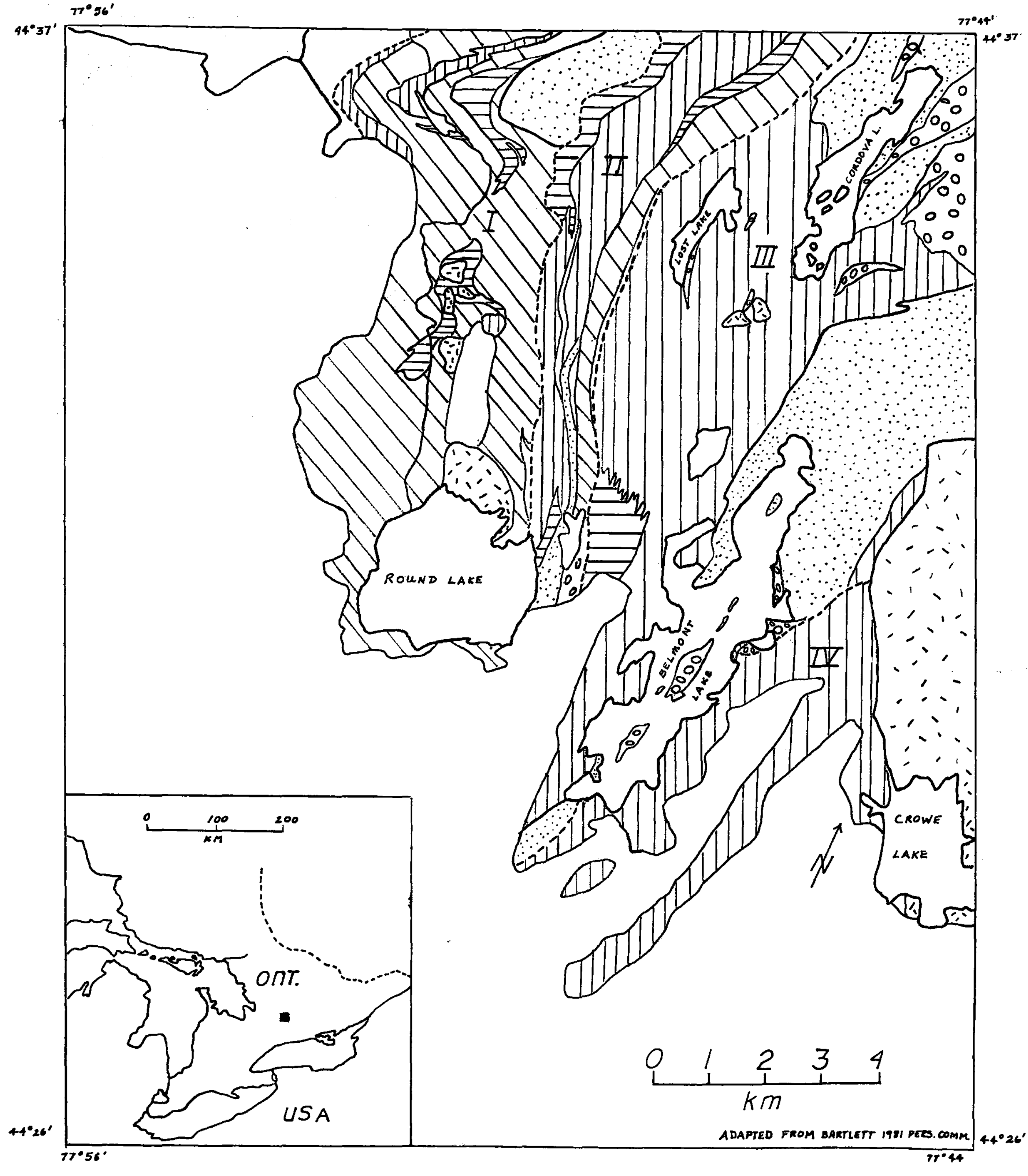
Felsic Metavolcanics

Intermediate Metavolcanics

Mafic Metavolcanics

---- Boundary between volcanic cycles

IV Volcanic cycle


77°56'
44°37'
77°44'
44°37'
I
II
III
IV
LOST LAKE
CORDOVA L.
ROUND LAKE
BELMONT LAKE
CROWE LAKE
N
0 100 200
KM
ONT.
USA
0 1 2 3 4
km
ADAPTED FROM BARTLETT 1981 PERS. COMM.
44°26'
77°56'
44°26'
77°44

intermediate and felsic tuffs. The felsic tuffs are especially dominant in cycle I and II and are composed of lithic fragments (Bartlett, 1980 pers. comm.).

Dolomitic and calcitic marble lie on top of the cycle I volcanics with some areas (such as Round Lake) showing pyritic metasediments before passing upward into the second volcanic cycle. Towards the (stratigraphic) top of cycle II and III, magnetite and pyrite bearing mudstones and siltstones are present. The pyrite character is also evident to a lesser degree in the underlying felsic tuffs (Bartlett, 1980 pers. comm.).

Cycle IV, exposed SE of Belmont Lake to SW of Cordova mines, is composed of basal mafic and intermediate metavolcanics -- also amygdaloidal and plagioclase phyric.

Based on pillow orientation and grading in the metasediments, Bartlett (1980 pers. comm.) has proposed that the volcanic cycles become younger to the east, meaning cycle I is the basal volcanic cycle in the sequence. Also present in the map area are medium to coarse grained metagabbroic intrusions. An interesting feature of the metagabbro is their multiphase multipulse features in which the gabbroic phase of the intrusive was brecciated by dioritic, quartz and grano-dioritic intrusions (Bartlett, 1980 pers. comm.).

The (overall) regional metamorphic grade increases from low to middle greenschist facies in Belmont to middle-upper amphibolite facies in S. Methuen (Bartlett pers. comm.

1980).

The Belmont Lake area contains metamorphosed conglomerate siltstones and mudstones which were mapped in detail and are the object of this study. Maps pertaining to the islands studied can be found in the back folder. The following are detailed descriptions of the lithologies on the islands with the finer grained lithologies supplemented by observations from thin sections. A detailed study of the petrology of the conglomerate is presented in a subsequent chapter.

CHAPTER THREE

FIELD STUDIES

Introduction.

Detailed mapping of five of the islands was done at a scale of 1 inch:500 feet (Map 1 and 2 in back pocket). In addition to mapping and sampling two point counts were done on Sidonia Island to establish modal percentages of clast and matrix, and to identify as many different types of clasts as possible.

Long Island.

Long Island lies immediately north-west of Birch Island on Belmont Lake and is actually composed of two islands. The northern island will be designated Northern Long Island and the southern island, Southern Long Island. Northern Long Island was not mapped in detail since the conglomerate was of major interest. Extensive mapping of Southern Long Island (Map 1) revealed three lithologies; the polymictic, clast supported Belmont conglomerate, a grey brown weathering siltstone, and a black magnetite mudstone. These units change only slightly in character along the length of the island. At the north-western shore of the island a sharp contact between the siltstone and conglomerate is exposed. The siltstone becomes finer grained towards the contact and is followed by a sharp grading into a coarser grained bed very similar in composition to the conglomerate matrix, and containing a few chert pebbles. Both graded bedding and rip up clasts in the siltstone indicate that the conglomerate overlies the siltstone. The conglomerate is polymict and is approximately 60-70% clast supported. The average clast varies from 1.6 to 3.5 cm in length. The dominant clasts are the dark grey fine grained felsic volcanics and dark grey chert clasts, usually indistinguishable in the field. The magnetite, limestone, quartz feldspar porphyry and quartz hematite sandstone clasts constitute only a minor fraction (5%) of the total clast population. Although the clasts are elongated, deformation is not extreme. The conglomerate has a dolomitic quartzo-feldspathic sandy matrix. The interbeds in Belmont Lake conglomerate are 15-20 cm thick with 5% pebble sized clasts and a complete absence of grading.

For the remaining southern half of the island, approximately 107 m, the stratigraphic section changes. The most westerly exposed lithology is the light red brown dolomitic siltstone exhibiting 1 mm thick bands of pyrite and biotite. The siltstone is normally graded showing tops to the east. Stratigraphically above (and to the east) of the siltstone, and exposed throughout the remaining length of Southern

Long Island is a magnetite mudstone. The contact between the mudstone and underlying siltstone is a sharp one delineated by change in colour, grain size and magnetitic character.

The mudstone is black and well laminated. Thin section study shows it to contain upwards of 25% euhedral magnetite phenocrysts, as well as a large amount of brown and green Fe rich biotite, and subrounded quartz. The banding in the mudstone is a result of biotite concentrations in certain beds.

The mudstone-conglomerate contact (Fig. 4) is a sharp one. Immediately above the contact the matrix of the conglomerate shows an increased amount of iron in the form of disseminated magnetite and pyrite. Increased amounts of hematite are also present. The iron content gradually decreases with distance from the contact. Not only does the matrix change but so do the clast types. At the contact, only red chert and black chert dominate with minor magnetite and tapered limestone clasts. With distance from the contact the clast population becomes more varied and includes quartz hematite sandstone, quartz feldspar porphyry with 1.2 mm blue phenocrysts, red and black chert, limestone, white quartz and felsic volcanic clasts. The conglomerate is poorly sorted and as a result these clasts may have a variety of sizes with no correlation between size and clast type. The interbeds in the conglomerate show well developed

Fig. 4. Mudstone-conglomerate contact on Southern Long Is. Notice the abrupt contact between the two lithologies and the banding in the mudstone.

Fig. 5. Sandstone interbed in the conglomerate on Southern Long Is. shows well developed normal grading


CENTIMETRE
INCH


CENTIMETRE
INCH

normal grading in this area (Fig.5).

Mary's Island.

Mary's Island is located just off the southern shore of Big Island on Belmont Lake (Map2). With the exception of the north-west shore, the island is composed of conglomerate. The Belmont Lake conglomerate here is more deformed than that exposed on other islands and as a result has larger and more elongated clasts.

The conglomerate is poorly sorted. Clast sizes range from 1.25 to 15 cm in length with the majority falling into the 5 to 10 cm range. There is no correlation between clast size and clast type. Most clasts exhibit extreme elongation.

The conglomerate is typically polymictic and clast supported; clast:matrix ratio is approximately 65:35 with clasts contacting one another. Clast types noted include blue quartz-feldspar porphyry, limestone, banded chert, white quartz, subrounded magnetite, (possible) felsic volcanic and black chert clasts. The latter type appears to dominate in the north and north-eastern shore. Along the western (and southern) shore the clast types are more varied, are larger and more elongated. At the south-western shore, the percentage of quartz feldspar porphyry clasts is greater than in any other exposure of conglomerate. Chert clasts showing grey and white internal banding and foliation (previous metamorphism?) are also quite prominent.

The quartzo feldspathic sandy matrix of the conglomerate is dolomitic, contains hematite, and is strongly magnetic. It retains this character throughout the island. The large amount of outcrop on Mary's Island contains numerous fine grained sandstone interbeds. The interbeds vary in thickness, some as large as 0.75-1.0 m thick, and are identical in composition to the conglomerate matrix. They are ungraded and have only a minor amount (5%) of subrounded siliceous pebbles. The contact between the interbeds andthe conglomerate is usually sharp. On the western shore, the conglomerate is strongly interbedded. It contains a series of eight interbeds, averaging 10.0 cm in thickness, over a lateral distance of 3m. The contacts are sharp, but these interbeds can only be followed for a short distance. Eastward from a conglomerate bed visible in the water on the western shore is a 45 cm thick interbed of siliceous, clean siltstone, containing cubic pyrite, dolomitic in character and similar to that seen on Birch Island. Interbedded with the siltstone are more dolomitic, finer grained beds of siltstone. The most westerly of these dolomitic beds has a thin 1 cm - 2 cm siltstone interbed which has been folded and fractured. The top of this bed contains siliceous clasts. Contact with the conglomerate is not sharp.

Raft Island.

Raft Island, just south of Big Island and Mary's Island, is composed entirely of conglomerate (Map 2). The overall characteristics and composition of the conglomerate are identical to that on the other islands with some minor differences. Clasts are on the average larger; measuring between 8 and 14 cm (Fig. 6). There is also a much greater range in clast size, indicating that the conglomerate is not as well sorted as in other exposures.

Sidonia Island.

Sidonia Island, located immediately north of Birch Island on Belmont Lake, is a small island composed almost entirely of conglomerate. Outcrop is unusually well exposed here, apparently due to weathering by exfoliation.

Because of the absence of bedding, grading, interbeds, and a contact with other lithologies, the stratigraphic position of the conglomerate on Sidonia is not known.

The clast supported and polymictic characteristics of the conglomerate are unchanged on Sidonia Island with respect to the other islands. Outcrop shows the matrix to be poorly sorted, a characteristic not seen in other exposures. On the eastern shore, 1 cm pyrite cubes and octahedrals are dispersed throughout the matrix and clasts but, are found predominantly in the matrix. This pyrite

Fig. 6. Close-up of the conglomerate on Raft Island showing elongation of the clasts.

is a late forming phase, probably the result of hydrothermal solution.

The only suitable exposure of Belmont Lake conglomerate for obtaining point count data in the area was on Sidonia Island where outcrop was wave washed and devoid of lichen. Two point counts were done on the east shore and the data are shown in Tables 1 and 2 and Fig. 11 and 12.

The first point count encompassed an area 90 x 52.5 cm. Points were tallied either as clast (C) or matrix (M) at 5.0 cm intervals along traverse lines approximately 7.5 cm apart. With each clast tally, the type of clast was recorded. The second point count encompassed an area 67.5 x 70.0 cm (Fig. 7). Again points were tallied either clast or matrix at 2.5cm intervals along traverse lines 7.5 cm apart and the clast type recorded.

From the point counts approximately thirteen different types of clasts were distinguished. These are outlined in Table 1 and some are shown in Figs. 8a, 8b, 9 and 10.

Plots of frequency versus clast type for traverse #2 (see Fig. 12) show a unimodal distribution. The dominant clast type is the black fine grained cherty textured clasts designated 4 (this includes 4a, 4b) and comprising 77% of the total number of clasts. However, traverse #1 (Fig.11) shows a bimodal distribution. In this area, black fine

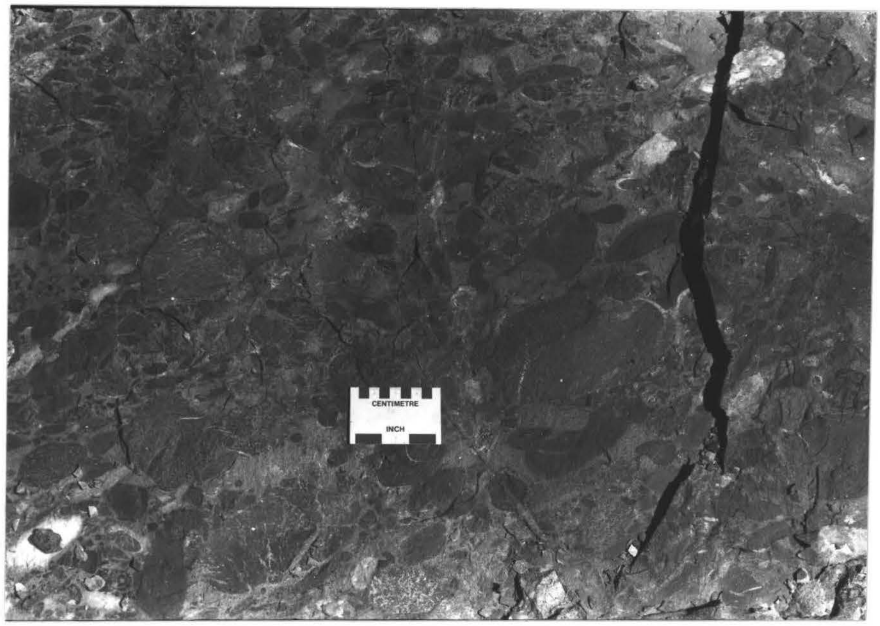
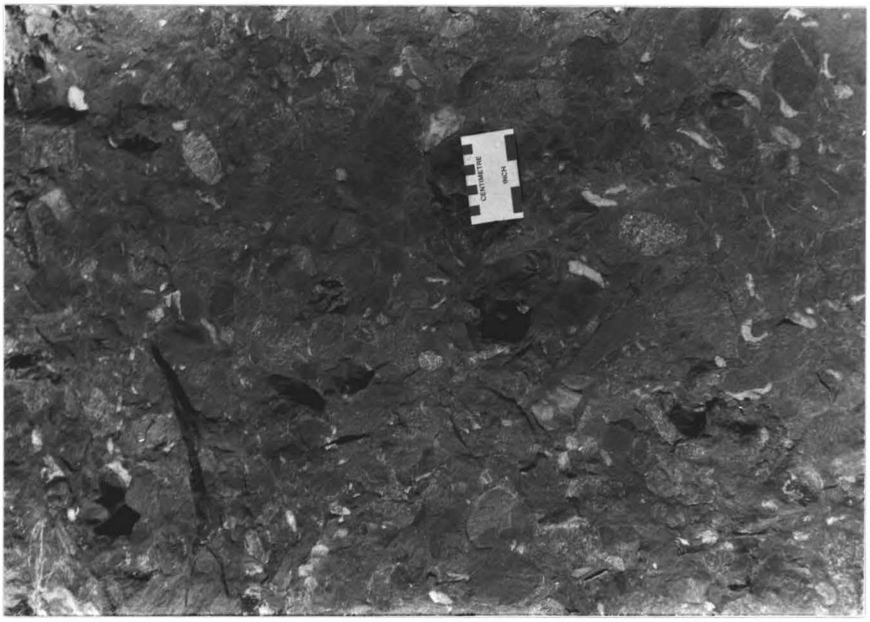


Fig. 7. Location of point count #2, Sidonia Island showing the predominance of the group of clasts labelled "black chert: but which included both chert and fine grained volcanics.

Fig. 8a. White subangular limestone clasts on Sidonia Island. These clasts were especially predominant on Sidonia, Mary's and Raft Islands.

Fig. 8b. Close-up of the recrystallized limestone clasts from Sidonia Island.


CENTIMETRE
INCH


CENTIMETRE
INCH

Fig. 9. Close-up of banded chert clast on Sidonia Island. The primary banding appears slightly deformed.

Fig. 10. Close-up of subrounded white quartz clast from the east shore of Sidonia Island.

TABLE NO. 1

CLAST TYPES (FROM SIDONIA ISLAND)

DESIGNATION	CLAST TYPE	DESCRIPTION
C1	QUARTZ FELDSPAR PORPHYRY	White, blue quartz phenocrysts in a pink feldspar matrix.
C2	LIMESTONE (Fig. 7a, 7b)	White, buff, crystalline.
C3	RED CHERT	
C4a	DARK GREY/BLACK CHERT	Aphanitic.
C4b	DARK GREY/BLACK CHERT	Not as fine grained.
C5	QUARTZ-HEMATITE SANDSTONE	Dark red and sometimes black, usually granular and always magnetic.
C6	BANDED CHERT (Fig. 8)	Usually white, black, and/or red, bands thin.
C7	SANDSTONE	Dark grey, fine grained with black quartz phenocrysts.
C8	WHITE QUARTZ (See Fig. 9)	Recrystallized.
C9	UNKNOWN	Clasts weather out as C2, but not calcareous.
C10	MUSCOVITE-BIOTITE	Dark grey-green on fresh surface.
C11	CHERT	Black and red chert, but not banded.
C12	FELDSPATHIC SANDSTONE	Dark grey, fine grained crystalline, feldspar, quartz, biotite.

TABLE NO. 2. POINT COUNT RESULTS FROM SIDONIA ISLAND.

POINT COUNT #1.

Run:	1	2	3	4	5	6	7
Clast / Total	12/19	11/18	10/19	10/19	16/20	12/19	13/19
Matrix / Total	7/19	7/18	9/19	9/19	4/20	7/19	6/19

Average Percentage of Clasts = 63.2

Average Percentage of Matrix = 36.8

Frequency vs. Clast Type

C-1	C-2	C-3	C-4a	C-4b	C-7	C-8	C-9	C-10	C-11
5/79	8/79	4/79	19/79	16/79	10/79	2/79	1/79	4/79	10/79

POINT COUNT #2.

Run:	1	2	3	4	5	6	7	8	9
Clast / Total	19/27	18/27	13/28	20/28	19/27	13/27	19/28	22/28	19/23
Matrix / Total	8/27	9/27	15/28	8/28	8/27	14/27	9/28	6/28	4/23

Average Percentage of Clasts = 66.6

Average Percentage of Matrix = 33.4

Frequency vs. Clast Type

C-1	C-2	C-3	C-4a	C-4b	C-7	C-8	C-10	C-11	C-12
3/122	5/122	1/122	80/122	14/122	4/122	1/122	3/122	3/122	8/122

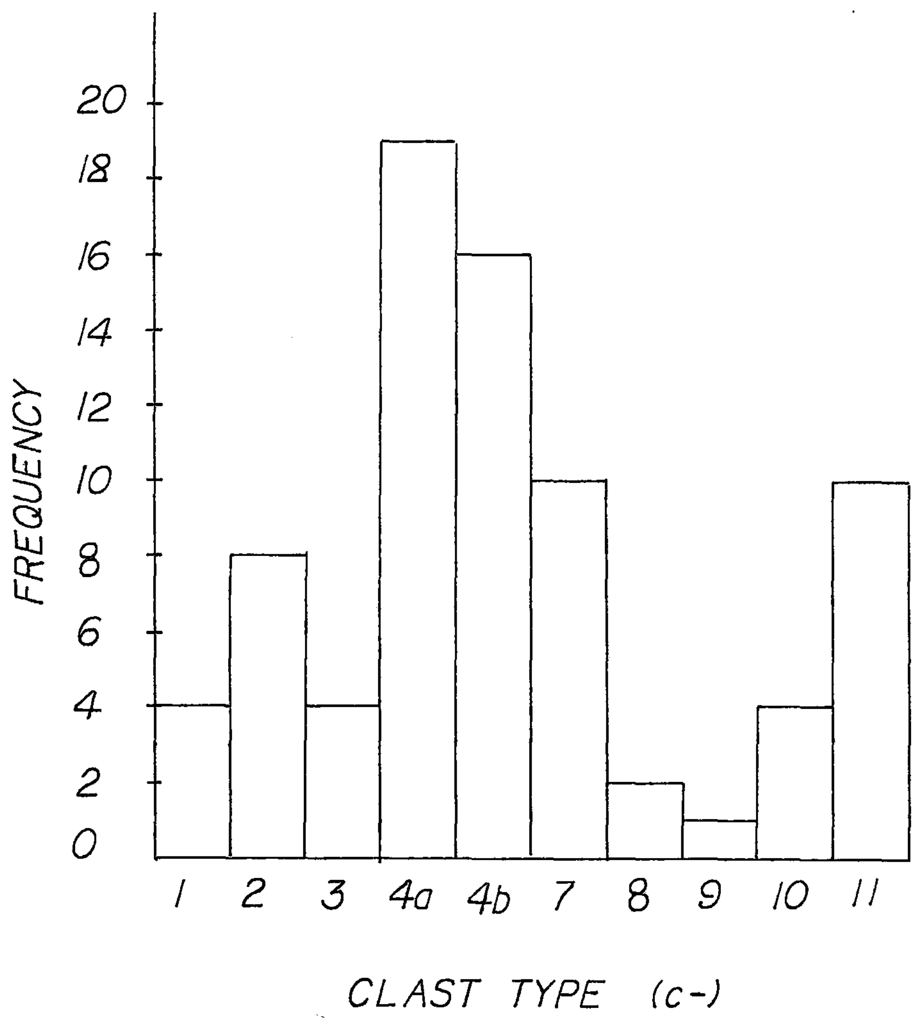


Fig. 11. Plot of frequency vs. clast type for point count # 1 on the east shore of Sidonia Island. Numbers are clast type designation.

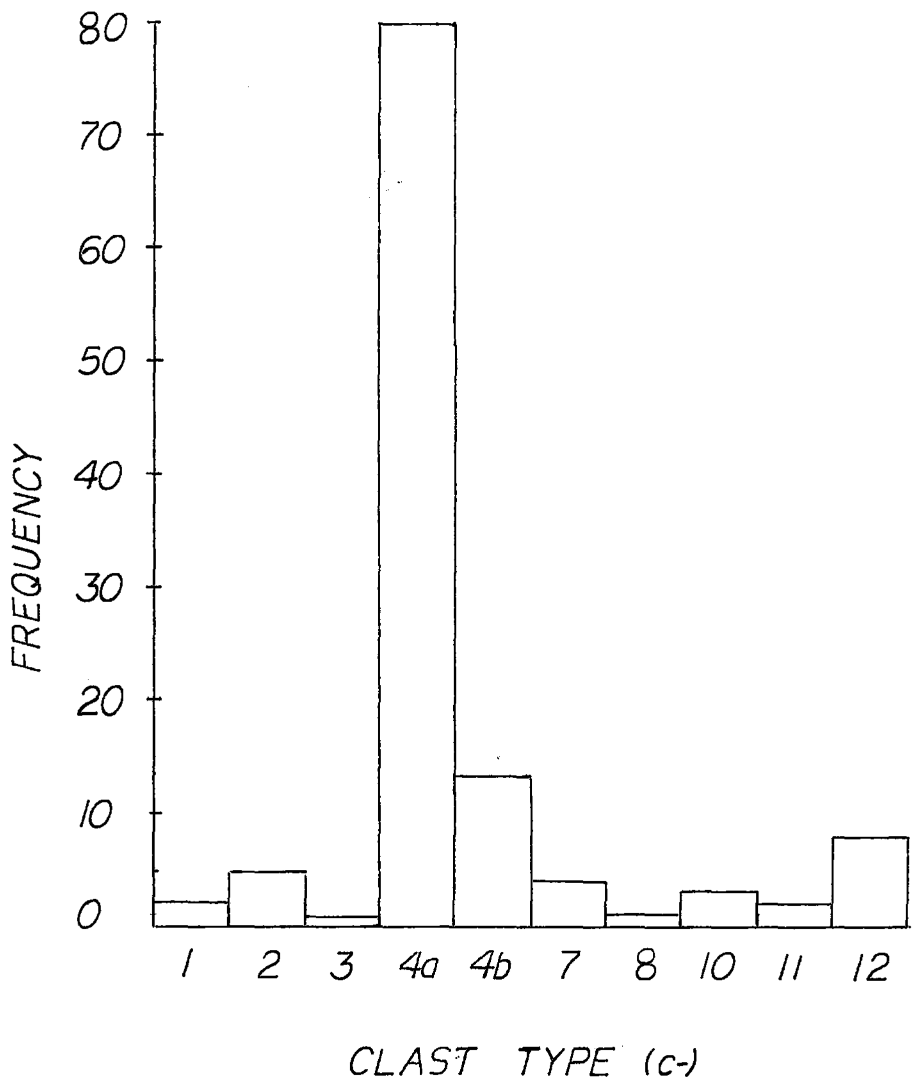


Fig. 12. Plot of frequency vs. clast type for point count # 2 on the east shore of Sidonia Island.

grained cherty textured (4a and 4b) and black and red fine grained cherty textured clasts dominate comprising 44% and 13% respectively.

Both point counts give similar clast to matrix values (expressed in terms of area) of approximately 2:1.

Birch Island.

Birch Island is the second largest and the most southerly island on Belmont Lake. The only major stratigraphic section of conglomerate is exposed on the north shore. This section, from west to east is as follows: interbedded quartz siltstone and argillite (argillaceous siltstone), mudstone, coarse pebble conglomerate, interbedded argillaceous (pebbly) sandstone and biotite schist, and quartzose marble. All the units occur as ridges striking north-south along the island with the best exposure at the northern end of the island. Beds in the stratigraphic section dip between 50-70° to the east.

Along the western and north-western shore (excluding the southern peninsula) (refer to Map 2) the interbedded siltstone and argillite outcrop. The siltstone dominates the entire western side of the island: it is exposed only as small intermittent outcrops. Although no compositional change is seen in exposures at the northern stratigraphic section, the siltstone does vary considerably in character. The siltstone is massive and grey, fine grained, has a somewhat cherty texture and commonly has a strong magnetic character. Thin section study shows this siltstone to have greater than 60% subhedral strained quartz with lesser amounts of plagioclase feldspar, and lepidoblastic brown biotite. The **magnetic** character is the result of the magnetite present and in addition there are minor amounts of hematite. The argillite is coarser-grained and has a slatey cleavage parallel to bedding. Thin section study along with field studies showed this black weathering siltstone to be rich in biotite (30-40%) and magnetite (at least 10%) and low (30% or less) in quartz content as compared with the siltstone. White mica porphyroblasts were also distinguished in thin section. Both the siltstone and argillite exhibit 1 mm laminations which weather to a white alteration product. The laminations in the more southerly exposures of the siltstone are usually deformed showing strong open folding, closing to the north. Thin section study also detected a fine grained, but well developed mica SSE-NNW schistosity parallel to strike. Some beds are very slatey with cleavage parallel to bedding. Several outcrops of siltstone on the northwest shore contained 0.5 mm porphyroblasts of dolomite which weathered out to give the siltstone a pitted appearance.

Outcrops of siltstone on the north-west shore exhibited normal grading, with decrease in grain size to the east, indicating tops in that direction so that the siltstone is the stratigraphic bottom of the sequence.

Stratigraphically above the siltstone is a brown weathering mudstone similar to the mudstone found on Southern Long Island. It has a strong magnetic character, is hematitic and shows well developed normal grading indicating tops to the east.

Outcropping immediately to the east of the mudstone is the Belmont Lake conglomerate. Similar to the other units, the conglomerate outcrops in a ridge running north-south and east of the swamp. The contact between the underlying mudstone is not visible. At the north-eastern end of island, the conglomerate appears to be interbedded with pebbly sandstone. The interbedded nature of the conglomerate and sandstone is only marginally exposed further inland.

The conglomerate is polymictic and clast supported with clast:matrix ratio approximately 70:30. The medium red-brown weathering dolomitic matrix contains areas rich in magnetite and hematite. The sulphides so common to the matrix on Long and Sidonia Islands, are not in evidence here. Instead, the quartzo-feldspathic sandy matrix contains 2-3 mm blue quartz grains which are very similar to the blue quartz phenocrysts in the quartz-feldspar porphyry clasts in the conglomerate. The matrix has a polymodal grain size with the blue quartz grains comprising the coarser fraction and the 0.5-1.0 mm quartz and feldspar grains occupying the finer portion.

The clasts are typically elongated and subrounded and show a poorly developed lineation; average trend 44° and plunge between $44-72^{\circ}$. There is a bimodal size distribution of the clasts; 1-3 cm and 4-10 cm. The larger sized clasts clearly dominate.

Identifiable clasts include quartz feldspar porphyry with blue and/or white quartz phenocrysts, red and black chert, granular quartz-hematite sandstone, white quartz and possible felsic volcanic clasts.

The conglomerate shows no evidence of sedimentary structures. One exposure of conglomerate at the northern shore of Birch Island shows some evidence of a gradational decrease in clast size to the east.

Immediately east of the conglomerate, the interbedded argillaceous pebbly sandstone and biotite schist outcrop. Contacts between the two units are sharp. Although best exposed at the northern end of the island, the sandstone is found in intermittent outcrops along the length of the island. The easternmost exposure of these lithologies at the northern shore is a massive dolomitic biotite schist showing no sedimentary structures, possibly as a result of metamorphism. Thin section study shows the schist to contain a substantial amount (50 percent or more) of lepidoblastic brown biotite and carbonate, with lesser amounts (20 percent) of alkali (microcline) and plagioclase feldspar and strained quartz.

The argillaceous sandstone contains 1-3 cm siliceous pebbles, very similar to the smaller cherty textured pebbles in the conglomerate. These pebbles are subrounded and elongated or are angular. In comparison to the biotite schist, this lithology has a lower biotite content. It is also coarser grained than the pebbly sandstone interbeds in the conglomerate. Thin section study showed a dramatic increase in the amount of strained quartz, present both in mono- and polycrystalline forms. and plagioclase and alkali feldspar. Minor amounts of pyrite, magnetite and carbonate (15 percent) were also detected. This is a decrease of approximately 50 percent of carbonate between the two interbeds.

Near the southern peninsula of Birch Island, close to the marble contact, outcrops of a finer grained siltstone unit lower in biotite content and very magnetitic in character were noted (Fig. 13). They are believed to be a part of the biotite schist-argillaceous sandstone unit, but not exposed elsewhere. Often this siltstone was found interbedded with the argillaceous sandstone. The siltstone showed normal grading, indicating tops to the east.

On the eastern shore, running north-south along strike is a whitish-grey, massive weathering dolomitic marble

Fig. 13. Outcrop of siltstone from southern Birch Island belonging to the sandstone-schist unit above the Belmont Lake conglomerate.

containing lenses of recrystallized quartz. The crystalline marble has at most 12 m of discontinuous lateral exposure and is the only unit found on the southern peninsula of the island. There are no sedimentary features present in the marble. Minor amounts of muscovite were noted in thin section study.

<u>Size Distribution of Clast</u>.

Measurements of clast axes were made from Sidonia, Mary's and Long Islands, and an attempt to plot them against clast type was made. However, due to the fact that the clast axes varied (from long (a) to intermediate (b)), such a plot proved to have little significance.

From field mapping there appeared to be no distinct relationship between clast size and type. The only exception was the black chert group which appears to have an average size of 1.0-3.0 cm (maximum length visible in outcrop). The clasts generally exhibit a large variation in size with most remaining in the pebble size of 4 mm - 64 mm on Long, Sidonia, and Birch Islands. Clasts, in the conglomerate on these islands, which are larger than 64 mm (cobble sized) are either quartz feldspar porphory or recrystallized white quartz. In addition Mary's, Raft and Big Islands contain the larger sized clasts. This is partly due to deformation which appears to have affected clasts more intensely in the Big Island-Mary's Island region. The variation in size may also be a function of poor sorting in the conglomerate.

CHAPTER FOUR

PETROGRAPHY

Introduction.

Petrographic studies of many clasts in the Belmont Lake conglomerate were made so as to aid in identification. Twenty-two thin sections were analyzed; 4 thin sections (containing 3 or more clasts) from slabs of conglomerate, and 11 thin sections of individual clasts extracted from the conglomerate. Also, the matrix of the conglomerate and all of the lithologies on Long and Birch Islands were studied. Some of the results have previously been discussed in the field studies chapter.

Staining with cobaltinitrate (Friedman 1971) was done on two slabs of conglomerate so as to distinguish between k feldspar and plagioclase.

This chapter will deal with descriptions of the clasts and present a petrologic summary. Clasts were classified into two groups: sedimentary and volcanic.

SEDIMENTARY CLASTS.

Chert Clasts.

Fine grained, cherty textured clasts dominate the Belmont Lake conglomerate as point counts on Sidonia

Island and detailed mapping on the other islands have shown. Included are red chert, black chert and various banded cherty clasts. Difficulty arises in the field in distinguishing between dark chert clasts and fine grained volcanic clasts which may also have a cherty texture. Thin sections analysis aided in the recognition of the volcanic clast types which were suspected but not positively identified in the field.

Red Chert.

One thin section of a red chert from Sidonia Island was studied. This clast has a strongly recrystallized texture. It contains sutured microcrystalline, strained quartz. Large patches of granular fine grained carbonate, probably secondary in origin are also present. Commonly associated with the carbonate masses are slightly larger polycrystalline quartz grains having micro inclusions. The clasts' red colour is the result of the euhedral to subhedral grains of hematite.

Dark Grey or Black Chert.

Thin section study of the dark grey chert clasts reveal that these clasts have also undergone recrystallization. This recrystallization is shown by the sutured texture of the quartz (Refer to Fig. 14 and 15). The microcrystalline quartz grains (less than 0.05 mm in size) comprises approximately 90% of the clast. The quartz shows typical strained extinction and contains micro inclusions. These clasts may also contain a small percentage of all or some of the following: euhedral magnetite, anhedral red translucent hematite, brown biotite and secondary carbonate.

Quartz-Hematite Sandstone.

The quartz hematite sandstone clast is a distinctive type of sedimentary clast in the conglomerate. It was seen on almost every island mapped as well as on some parts of the eastern shore of Belmont Lake (such as Conglomerate Point). It is composed of 80% quartz, 10% disseminated hematite which results in the clasts' distinctive red colour, magnetite and secondary polycrystalline twinned carbonate.

Figure 16a and 16b is a photograph illustrating the clasts recrystallized texture. The subrounded 0.1 mm - 0.5 mm quartz displays both undulose and regular extinction; the former being more common. Small inclusion of red anhedral translucent hematite are common in much of the quartz as is shown in Figure 13b. Notice that the grain size of the quartz is smaller with the increased content of hematite and magnetite. This is due to the fact that the opaques have inhibited grain boundary migration during recrystallization causing the quartz grains to remain small. (Nockolds, Knox, Chinner, 1978). The texture, grain size and composition designate this clast as an iron rich quartzite.

Marble.

These clasts are especially dominant on Sidonia Island, tend to be very elongated, and weather out. They are strongly calcitic.

The marble clasts consist of 90% anhedral 1 mm calcite (Fig. 17) which show polysynthetic twinning, and minor amounts of brown-green biotite. Traces of magnetite, strained quartz and euhedral feldspars which show remnant albite twinning and are in the process of being altered to alkali feldspar are present also.

As Figure 17 shows, the clast has a sutured texture with many of the carbonate grains outlined by hematite. This clast differs from the marble which lies above the conglomerate on Sidonia Island, in that it lacks the quartz lenses and muscovite.

Conglomerate Matrix.

The matrix of the Belmont Lake conglomerate (Fig. 18a) is quartzo-feldspathic in composition. The quartz grains which are 0.8 mm or less in size and subhedral, are either monocrystalline or polycrystalline and show strained extinction. Quartz comprises no more than 30% of the matrix. At least 35% of the matrix is composed of 1 mm or less plagioclase and alkali feldspar. The anhedral feldspars show two different types of textures. Some feldspars have a poikilitic texture due to inclusions; i.e. alteration to sericite. The plagioclase feldspar commonly has poorly defined complex twins of carlsbad and albite, but may be untwinned. Many of the twinned plagioclase feldspars show a myrmeketic texture. This texture is defined by the irregular appearance of the twin lamellae, and the disappearance, in patches, of twinning. Alkali feldspar is not as common as plagioclase but was confirmed through staining. It is usually present in the form of microcline.

Brown pleochroic subhedral biotite is a common component of the matrix. A significant (10%) portion of the matrix is composed of sutured, polysynthetically twinned, subhedral carbonate. Some sections (such as that from Sidonia Island) showed a carbonate content as high as 40%. In some areas, the carbonate gives the matrix a mosaic texture.

The matrix of the conglomerate also contains a large amount of disseminated magnetite, present as euhedral square crystals, granular yellow epidote, and red translucent hematite.

An interesting feature of the matrix is the presence of small 1 mm fragments of clasts. These clasts are either recrystallized chert (Fig. 18b), showing strong undulatory extinction, or more rounded, smaller felsic volcanic clasts exhibiting felty textured plagioclases. No other clast types were noted.

Muscovite-Biotite Schists.

One clast type common to Sidonia, Long and especially Raft Island was a phaneritic dark grey weathering clast showing white weathered phenocrysts of plagioclase feldspar. These schists were distinguishable not only by their weathered appearance, but also by their tendency to be extremely elongated.

Thin section study of one such clast from Sidonia Island showed that the original texture is almost completely obscured by mica (Fig. 19). The fine grained white mica comprising at least 40% of the clast shows a well developed foliation. Larger subhedral white mica porphyroblasts exhibiting slightly bent lamellae show no folliation. Green and brown pleochroic biotite porphyroblasts also show no foliation.

At least 30% of the pebble is composed of polycrystalline strained, 0.5 mm or smaller quartz grains which along with feldspar formed the primary mineralogy. The anhedral, complexly twinned plagioclase and microcline twinned alkali feldspars are extensively altered. The minerals show strong recrystallization effects with the sutured and strained extinction texture. Disseminated opaques are found throughout the clast.

Another schist studied from the same island showed the same texture and mineralogy except for minor amounts of hematite and carbonate, both of which were secondary. In hand specimen this muscovite, biotite schist was was phaneritic, with 0.5-0.6 mm aggregates of biotite and weathered grey-green.

Arkose (Feldspathic Sandstone).

These clasts are not common to the Belmont Lake conglomerate and were only seen on Sidonia Island. White plagioclase feldspar crystals weathering up, give the clast a distinctive phaneritic appearance.

Thin section study done on the sandstone clast extracted from the outcrop on Sidonia Island revealed a clast composed of 35% brown, pleochroic biotite, 40% plagioclase feldspar, and 10% each of quartz, carbonate, and white mica (muscovite). There are minor amounts of red translucent hematite

The 0.5-2.0 mm plagioclase feldspars are angular laths and exhibit complex twinning some of which is deformed. In addition, the feldspars are undergoing alteration shown especially in the twin lamellae, producing a somewhat myrmeketic texture. In some feldspars patches of microcline twinning are visible. Further alteration is shown by the presence of sericite (Fig. 20). Some of the plagioclase show strained extinction.

The biotite and white mica are interstial to the plagioclase and strained quartz and appear to be a metamorphically derived phase.

VOLCANIC CLASTS

Dacite and trachyte clasts.

These clasts are virtually indistinguishable in hand specimen from the sedimentary chert clasts because of their aphanitic texture. In thin section however, they can be distinguished most easily. Two types of volcanic clasts were recognized in thin section.

The first type was the least common of the two and is approximately dacitic in composition. Thin section study revealed that these intermediate volcanic clasts are comprised of 10% feldspar phenocrysts set in a fine grained groundmass. In some sections the feldspars may be very large and comprise 25% of the clast. The 1-3 mm lath-shaped feldspar phenocrysts exhibit complex twinning and show extensive sericite alteration (Fig. 21a). Because of the alteration, twinning is not easily distinguished and thus, An compositions could not be determined. The groundmass is composed of 60% subhedral strained quartz, lath-shaped feldspars, and secondary anhedral carbonate. The only mafic constituent of the clast is found in the groundmass as green, pleochroic biotite. Small euhedral square magnetite is disseminated throughout the groundmass.

The groundmass of these clasts show strong recrystallization as seen by the mosaic texture and strained extinction of both feldspar and quartz (Fig. 21b).

In thin sections taken of conglomerate slabs from Sidonia and Long Islands, these intermediate volcanic clasts usually occupied the smaller size range. One of the separate clasts removed from the conglomerate on Sidonia Island also had a similar texture and composition. This aphanitic clast weathered medium grey and was very common on Sidonia Island.

These clasts are usually composed of less than 10% phenocrysts and the phenocrysts are always anhedral - to subhedral complexly twinned plagioclase feldspar which have undergone sericitization. In some cases the twinning occurs in patches giving the feldspar an unusual texture.

The most distinguishing feature of these clasts in thin section, is the 'felty' texture of the groundmass resulting from the random orientation of predominantly Carlsbad-twinned lath feldspars (Fig. 22a and 22b). The groundmass is composed of 70-80% anhedral to subhedral lath-shaped feldspars exhibiting Carlsbad twinning (Fig. 22b). (Polysynthetic twinning is less common.) The twinning is somewhat obscured by the presence of very finely disseminated anhedral opaques (possibly hematite). Minor amounts of strained quartz (5-10%) and patches of anhedral untwinned carbonate are also present. The amount of brown biotite varies but is the only mafic constituent.

Felsic Porphyry.

Only one type of porphyry was noted in both field work and thin section study. The quartz feldspar porphyry were especially distinctive in the field as they usually had blue or white quartz phenocrysts set in a pink matrix. In thin section analysis, this porphyry is shown to consist of 40 percent subhedral to euhedral quartz, plagioclase feldspar phenocrysts set in a fine grained groundmass. This results in a porphyritic texture as shown in Figure 23a.

The 0.5-1.00 mm quartz phenocrysts are generally monocrystalline but there are several that are polycrystalline. Although free of alteration generally, a few of the quartz phenocrysts are fractured and show inclusions, and all show strained extinction. Quartz comprises 50% of the total phenocryst population. The 0.2-1.0 mm plagioclase phenocrysts show some combination of Carlsbad and polysynthetic albite twinning. No exact composition was obtained for the plagioclase feldspar.

The feldspars show extensive alteration to sericite and contain anhedral masses of hematite. Both feldspar and quartz phenocrysts in the porphyry are sometimes sutured as Figure 23b shows.

The fine grained groundmass shows extensive recrystallization as it has a sutured texture. Quartz and feldspar exhibiting undulose extinction comprise a large percentage of the groundmass, at least 70%. Both biotite and muscovite are present in small amounts (less than 20%). The biotite is commonly associated, as tabular aggregates, with anhedral hematite, while muscovite is seen more commonly with the quartz and feldspars. Secondary carbonate is also present.

Felsic Tuff.

These clasts were commonly seen on Sidonia Island and are probably present on several of the other islands as well. Fine grained and weathering light grey, on the fresh surface they are aphanitic and resemble the black chert clasts. Due to recrystallization it is difficult to distinguish this clast definitely from a recrystallized chert since a recrystallized tuff may often look identical.

In thin section this clast was shown to contain 25% crystal and rock fragments. The crystal fragments are predominantly plagioclase feldspar and subhedral quartz. The feldspars have a myrmeketic texture and the quartz exhibits undulose extinction. Hematite also occurs in large crystals but these are believed to be secondary in origin.

The rock fragments are composed entirely of subangular to subrounded and are composed entirely of recrystallized strained micro crystalline quartz and muscovite. They range in size from 3 mm to less than 0.5 mm.

The rock and crystal fragments are set in a strongly recrystallized matrix composed of microcrystalline.

Petrographic Summary.

From the petrological study done on the Belmont Lake conglomerate, the following conclusions can be made:

1. Almost all of the clasts exhibit recrystallization features defined by sutured or mosaic textures, strained extinction in quartz and feldspar, and deformed twin lamellae and cleavage traces (in feldspars and micas respectively). All lithologies associated with the conglomerate also show recrystallization textures.

2. Foliation of platy minerals such as biotite and muscovite is almost non-existent, with the exception of the argillaceous siltstone on the west shore of Birch Island.

3. Epidote is common in the conglomerate matrix and several of the volcanic and sedimentary clasts.

4. The conglomerate slab thin sections revealed that many of the clasts are rimmed by aggregates of biotite, see Fig. 15, carbonate or recrystallized quartz. The presence of biotite represents the formation of a hydrous phase during metamorphism in water rich sediments.

5. The large number of recrystallized quartz veins cutting the clasts and the matrix, as well as the presence of hematite and pyrite in the matrix indicate extensive hydrothermal activity in the conglomerate. Extensive field evidence supports this conclusion. Small quartz veins were seen cutting obliquely through the conglomerate on

Long Island. The Belmont Township area also shows extensive quartz veins often associated with minerals of economic importance such as sulphides and gold.

6. Petrographic study supports the conclusion reached from field observations and point count data, that although the conglomerate is polymictic, sedimentary chert and volcanic clasts seem to dominate the clast population.

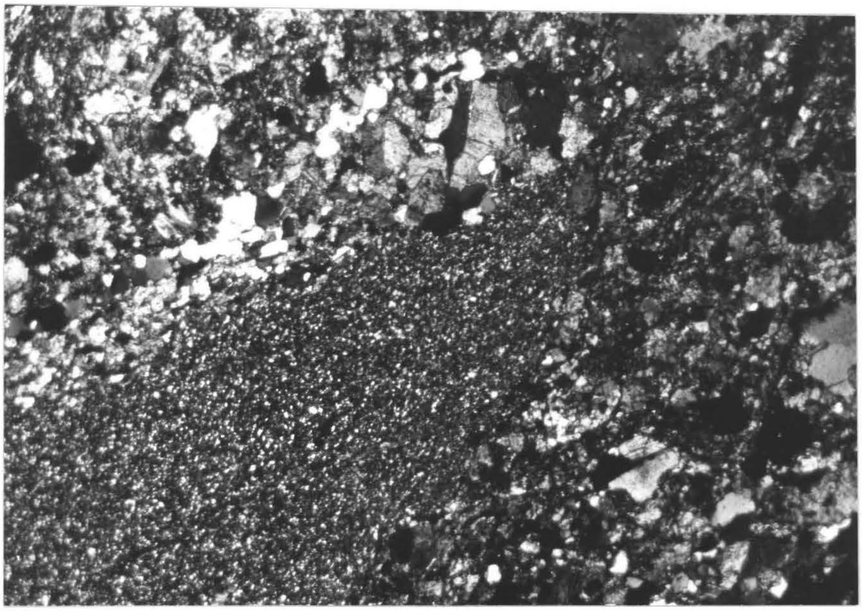
It appears that the most common type of volcanic clasts are those having compositions approaching dacites or trachytes.

7. Examination of the conglomerate matrix shows subrounded to angular quartz and feldspar indicating the possibility of a local provenance.

8. The mineral assemblage from the sedimentary rocks on Birch and Long Island is quartz + plagioclase $\pm$ muscovite + biotite $\pm$ epidote + calcite or dolomite which belongs to the quartz + albite + epidote + biotite subfacies of the greenschist facies.

Fig. 14 Photomicrograph of conglomerate showing elongated, recrystallized chert clast rimmed by biotite. To the lower right barely distinguishable from the matrix, is a felty-textured volcanic clast. Sample is from Birch Island. Magnification is 10X.

Fig. 15. Photomicrograph showing recrystallized chert clast set in matrix which is enriched in strained quartz and carbonate near the clast edge. Sample is from Birch Island. Magnification is 25X.



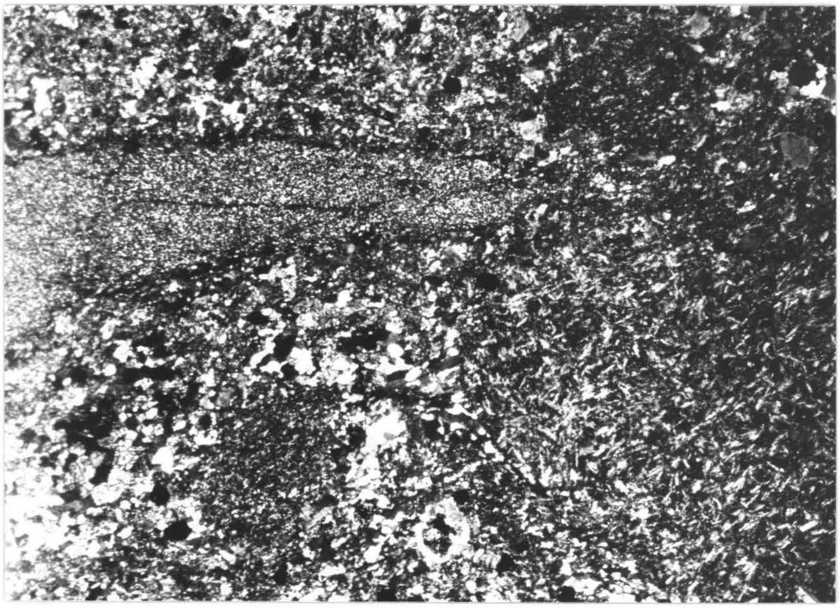
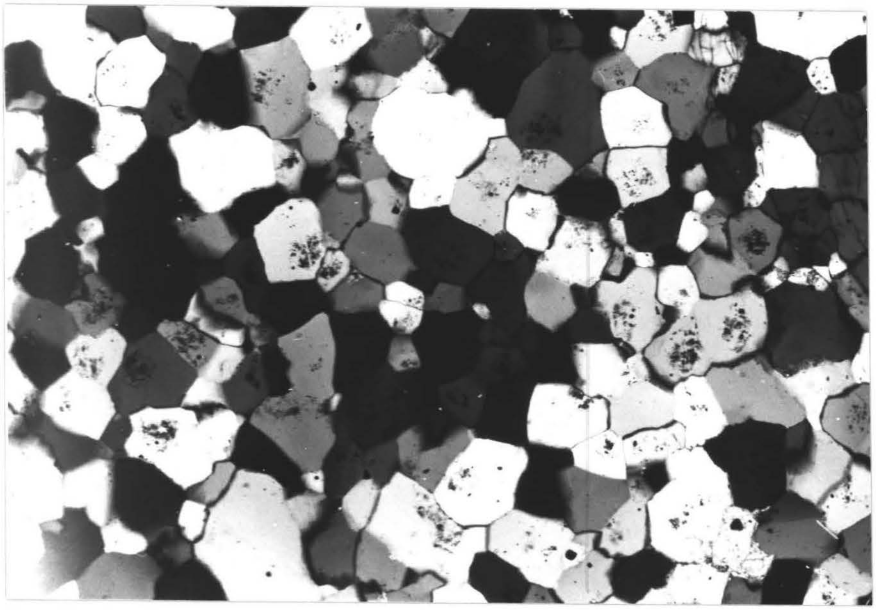
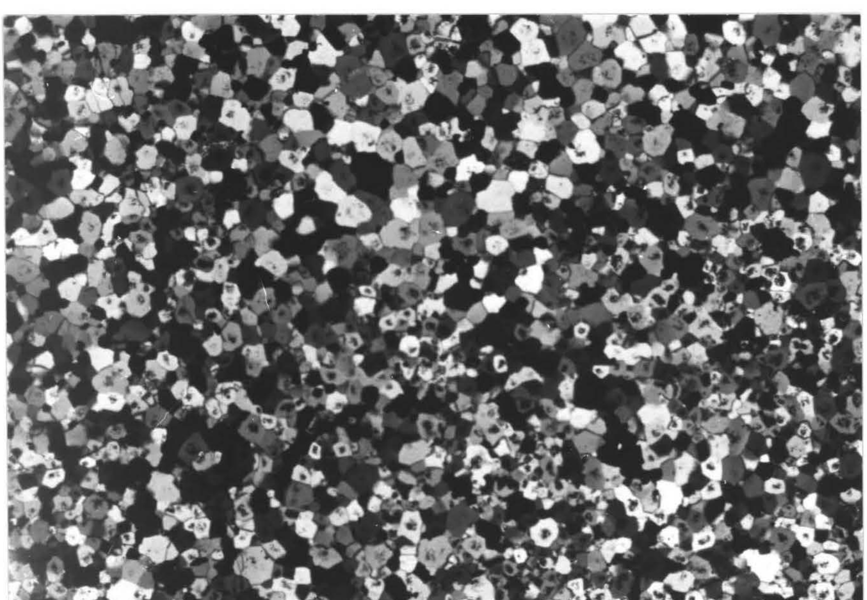


Fig. 16a. Photomicrograph showing the sutured texture of the quartz-hematite sandstone clast. Sample is from Sidonia Island. Magnification is 63X.

Fig. 16b. Photomicrograph from the same thin section shown in Fig. 16a. but from a finer grained part of the clast. Notice the positive correlation between smaller crystal size and increased opaque (hematite) content. Magnification is 25X.





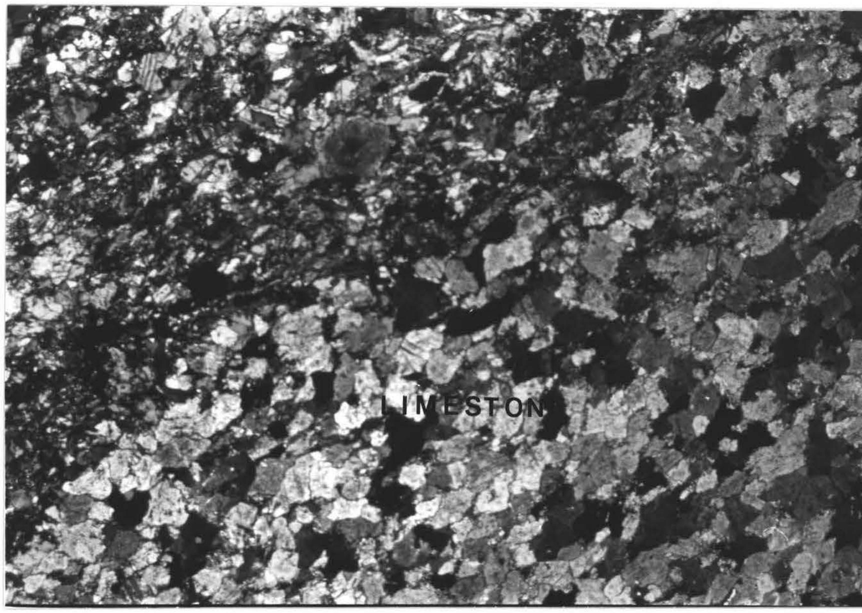
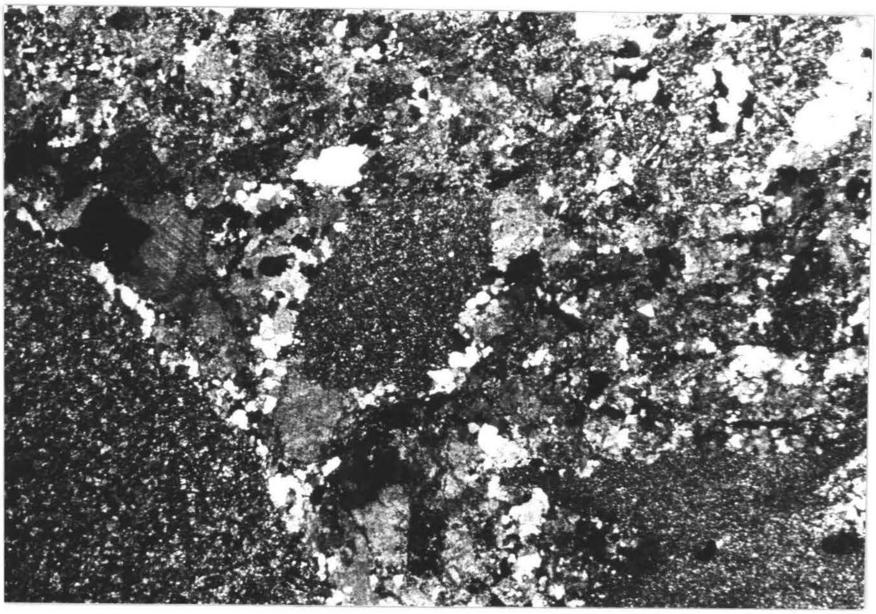


Fig. 17. Magnification (25X) of the corner of a recrystallized limestone clast showing the mosaic texture. Sample is from Birch Island.

Fig. 18a. Photomicrograph of the matrix of the Belmont Lake conglomerate showing the recrystallized texture. Rims of strained quartz around clasts such as the recrystallized chert clast in the lower left corner are common. Sample is from Sidonia Island. Magnification is 10X

Fig. 18b. Photomicrograph of the matrix of the conglomerate on Birch Island. Numerous small chert clasts are visible. The matrix is not as carbonate rich as that on Sidonia Island, shown in Fig. 18a. Magnification is 25X.



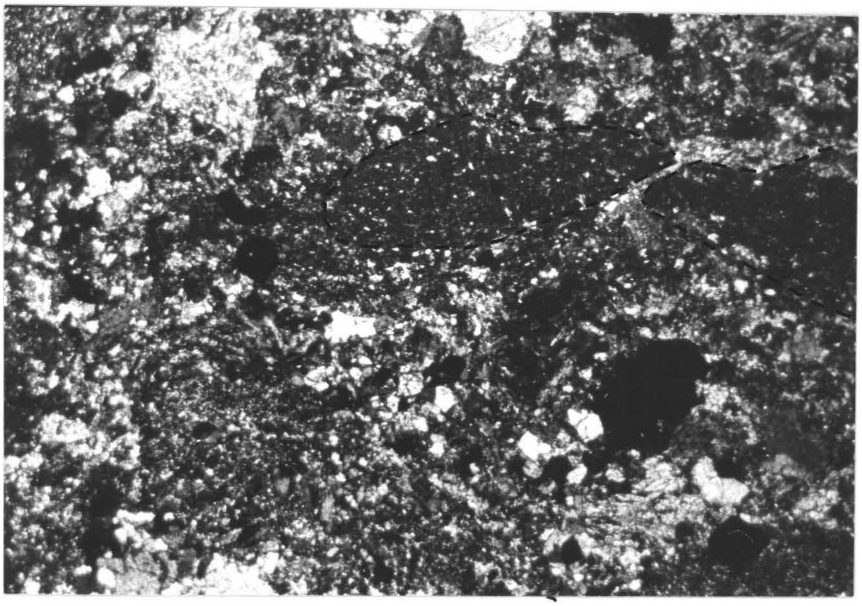
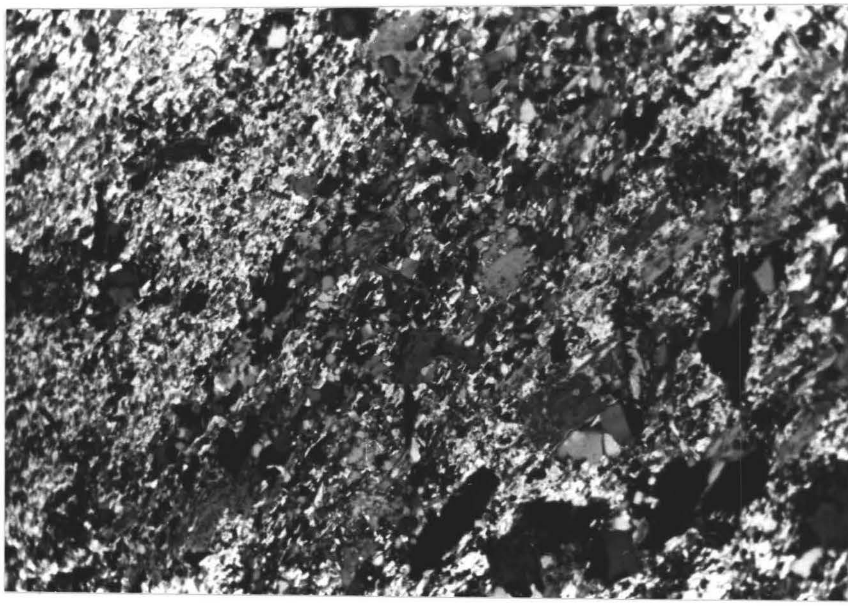


Fig. 19. Photomicrograph of the mica schist showing the primary mineralogy which is now recrystallized, obscured by white mica. Sample is from Sidonia Island. Magnification 63X.

Fig. 20. Closeup of an anhedral, sericitized plagioclase feldspar set in a recrystallized matrix of quartz, feldspar and biotite. Sample is from Sidonia Island. Magnification 63X.



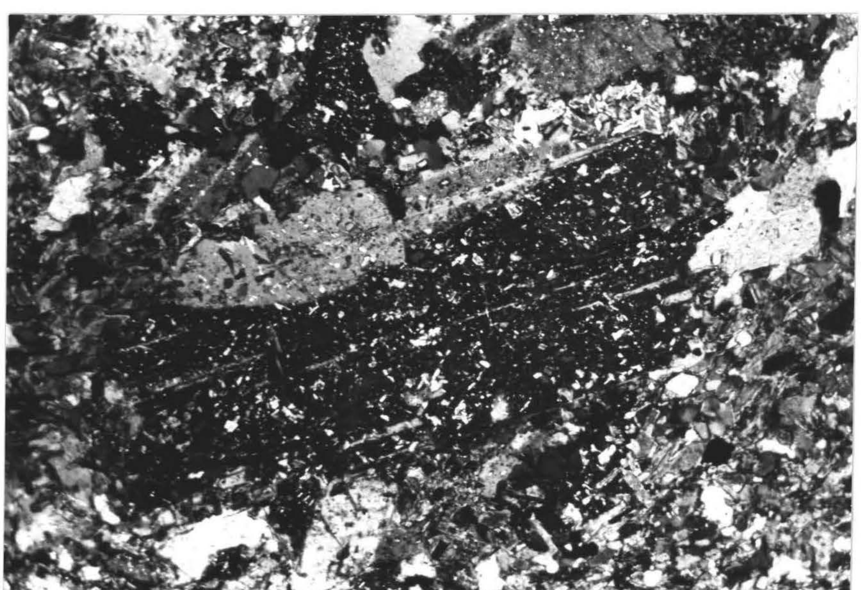
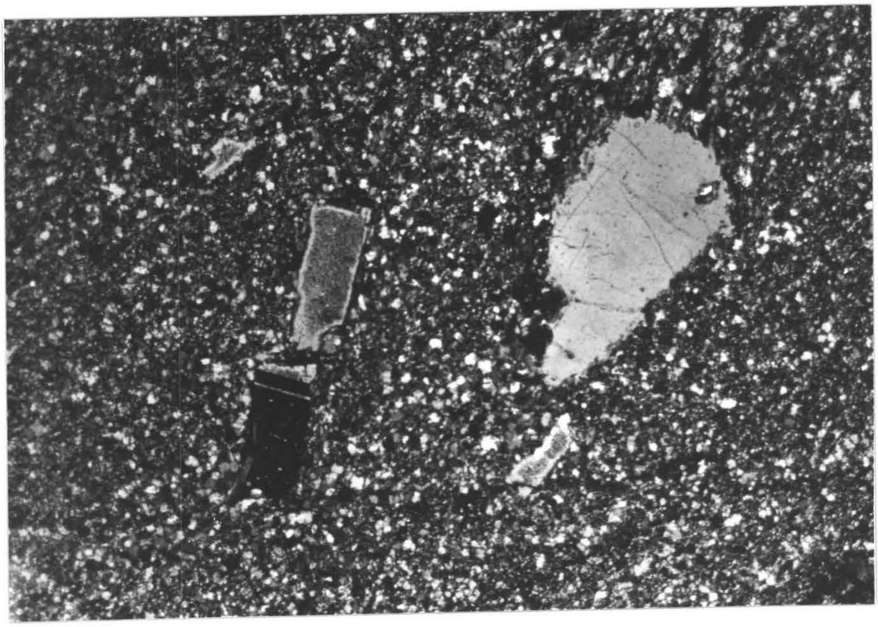


Fig. 21a. Photomicrograph of intermediate (dacite) volcanic clast from Sidonia Island showing euhedral plagioclase feldspar and subhedral quartz phenocrysts set in a recrystallized groundmass. Magnification is 25X.

Fig. 21b. 63X magnification of complexly twinned plagioclase phenocryst set in recrystallized groundmass. Sample is also from Sidonia Island.



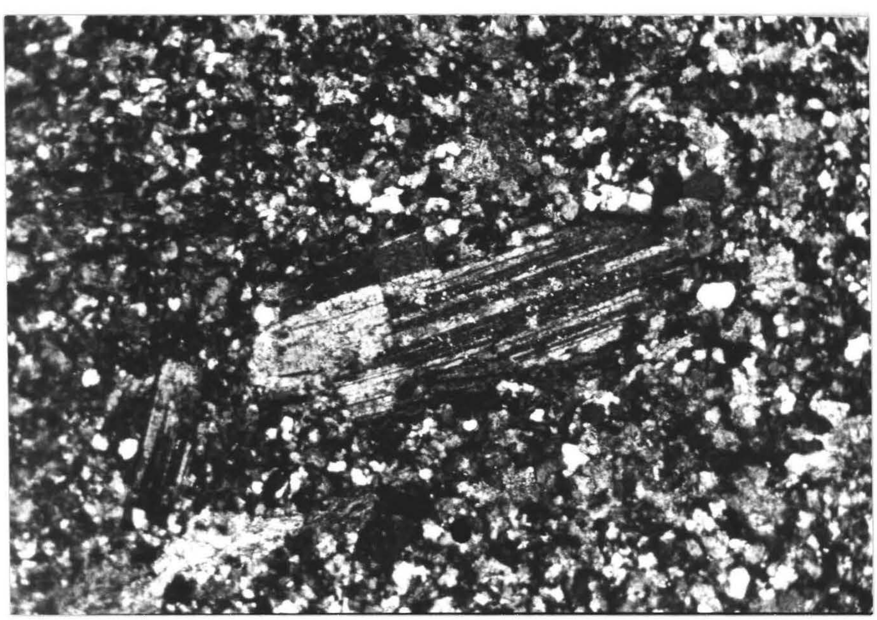
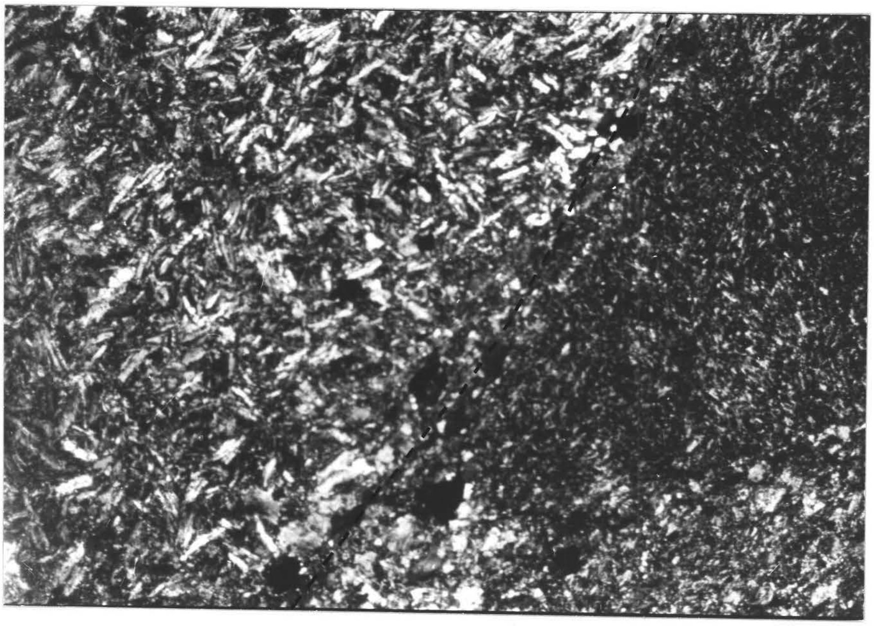


Fig. 22a. 25X magnification of trachyte clast (outlined) showing characteristic felty texture. Sample from Birch Island.

Fig. 22b. Photomicrograph of altered, Carlsbad twinned phenocryst in trachyte clast. Magnification is 63X.



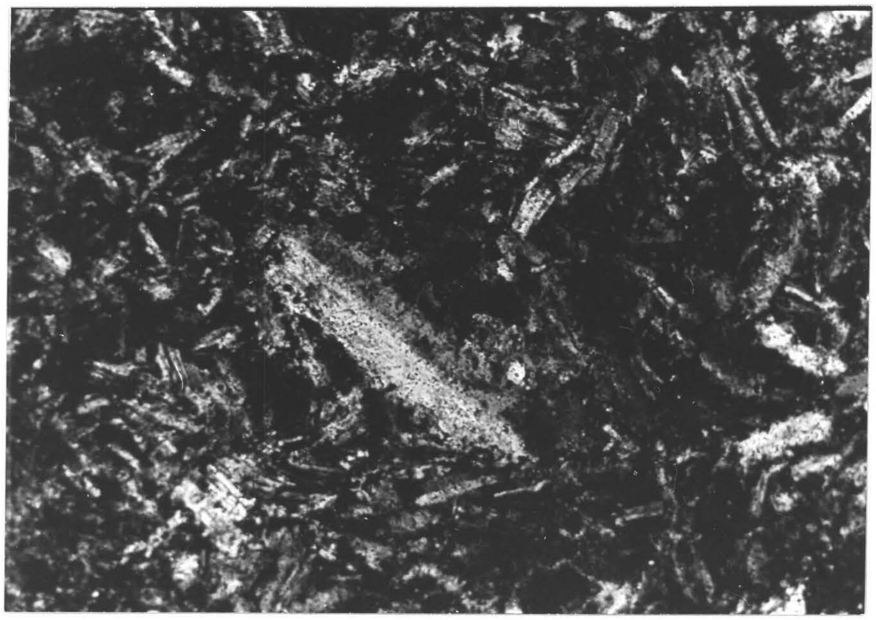
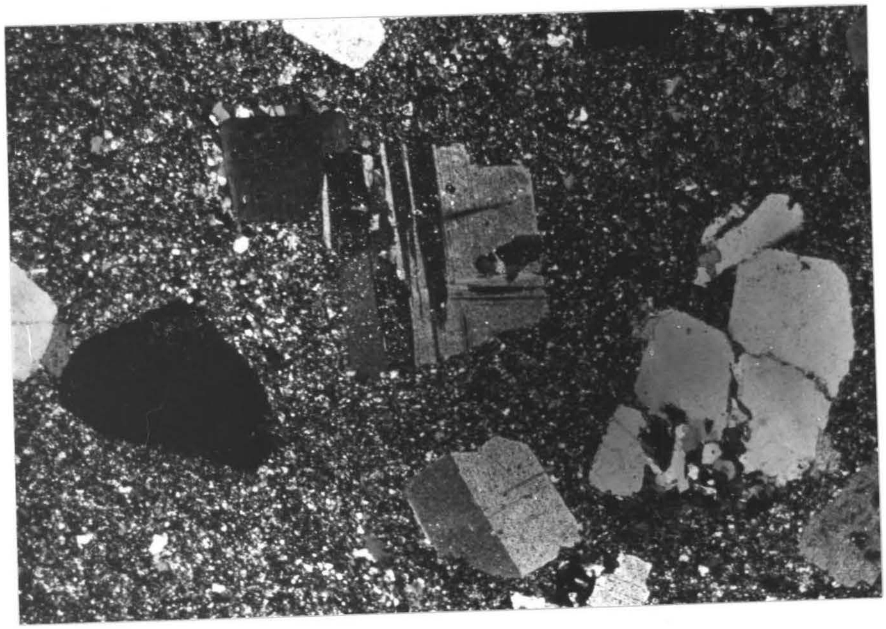
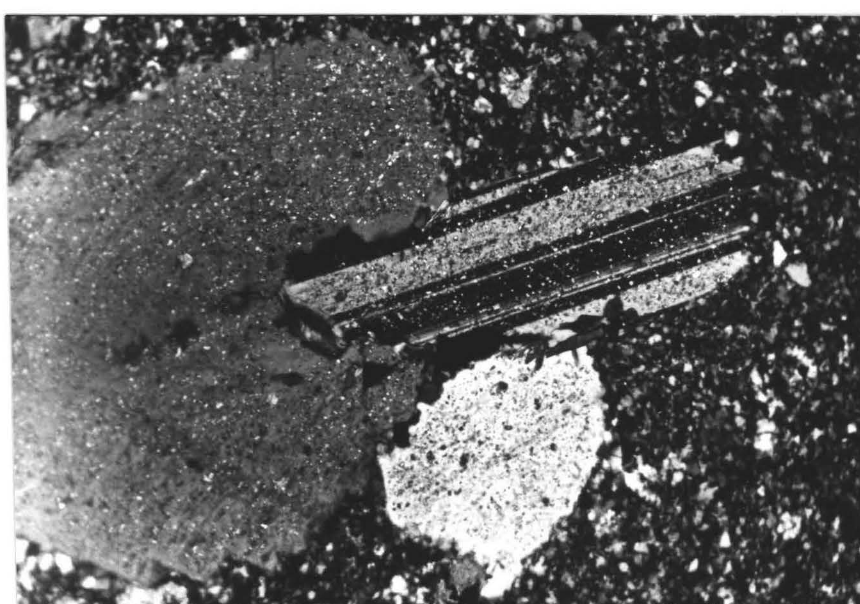


Fig. 23a. Photomicrograph showing porphyritic texture of the quartz feldspar porphyry clasts. Sample is from Sidonia Island. Magnification is 25X.

Fig. 23b. 63X magnification showing the sutured texture that some of the phenocrysts exhibit in the porphory. A complexly twinned plagioclase feldspar and two subhedral quartz phenocrysts are shown sutured.





CHAPTER FIVE

DISCUSSION

Stratigraphy.

In a previous chapter (Ch. 2), a summary of the regional geology of Belmont Lake-Southern Methuen Township was presented showing that at least 4 volcanic cycles are present in the area; three subaqueous, and one subaerial (cycles IV). Out of this general geology and stratigraphy arises the problem concerning the stratigraphy of the Belmont Lake conglomerate with respect to the clastics and their stratigraphic position relative to the metavolcanics.

Regarding the stratigraphy of the clastics, Miller and Knight (1914) are ambiguous about the position of the conglomerates with respect to the associated marbles, siltstones, mudstones and sandstones particularly with regard to the section on Birch Island. The dolomitic marble on the east side of the island was placed by them as stratigraphically below the conglomerate and labelled Grenvillian. The conglomerates were then labelled as a member of the younger, less deformed Hastings formation. As to the clastics on the west side of the conglomerates, Miller and Knight (1914) state that these might also be classified with the Grenville but are "provisionally placed with the

Hastings series". As mentioned previously, graded bedding found by the author in both the mudstone and siltstone, indicates that the dolomitic marble lies above the conglomerate on Birch Island. Mapping of Big Island by O. G. S. (Bartlett 1981 pers. comm.) shows conglomerate, sandstone and siltstone both stratigraphically above and below the dolomitic marble.

Thus, at the present time there does not appear to be a definite stratigraphy where the conglomerate is always found stratigraphically above the dolomite for example. Rather, it appears that the Belmont Lake clastics show continuous interbedding of sandstone, siltstone, mudstone and marble representing changing depositional conditions.

The problem of the stratigraphic position of the conglomerate relative to the metavolcanics is accented by the lack of a visible contact between the conglomerate and associated clastics with the metavolcanics. The closest approach (to such a contact) comes on the east shore of Belmont Lake approximately 0.4 km north of Wilson Bay. Here a small outcrop of felsic tuff, most likely from cycle III, is seen to the east of the Belmont Lake clastics. It is possible that these tuffs underly the clastics found both to the west and east. Also on the east shore of Belmont Lake and on Sammy Island (which is located on northern Belmont Lake), mafic volcanics are found with dolomitic marble. There appear to be some mafic volcanism, perhaps the beginning of cycle IV, associated with the Belmont Lake clastics (Bartlett, 1981 pers. comm.).

Bartlett places the Belmont Lake conglomerate above the third volcanic cycle and possibly penecontemporaneous with the beginning of the fourth volcanic cycle. The former conclusion is based on the above outcrop data plus the similarity of the ironstones present at the top of cycle III to the quartz-hematite-magnetite clasts seen in the conglomerate on Sidonia, Birch, and Southern Long Islands. Also, this study has shown the presence of tuffaceous clasts in the conglomerate (from Sidonia Island) which may possibly have been derived from the cycle III felsic tuffs.

Table 3 compares the stratigraphy Miller and Knight (1914) proposed for the area and that proposed by Bartlett (1980 pers. comm.). Petrographic and field study of the conglomerate by the author agrees with this stratigraphic position proposed by Bartlett.

Provenance.

Miller and Knight (1914) state that "the conglomerate holds pebbles of some but not all, of the older rocks exposed in the area". Petrographic study of the clasts in the Belmont Lake conglomerate has confirmed this. In addition to the above mentioned ironstones and tuffs, chert and quartz have been found as clasts and are also present

TABLE 3

STRATIGRAPHY OF BELMONT TOWNSHIP ROCKS

Bartlett (1981 pers. comm.)	Miller and Knight (1914)
<u>CYCLE IV</u>	<u>KEWEENAWAN</u>
Mafic & Intermediate Flows	Belmont Basalt, Tuff Belmont Gabbro-diabase
Belmont Lake Conglomerate	IGNEOUS CONTACT
<u>CYCLE III</u>	<u>HASTINGS</u>
Pyritic Siltstones Magnetite-quartz Ironstones Magnetitic {Felsic / Intermediate} Flows Pillowed Mafic Flows	Slate, Quartzite, Greywacke Conglomerate & Slate
	GREAT UNCONFORMITY
<u>CYCLE II</u>	<u>GRENVILLE</u>
Pyritic Siltstone Felsic Tuffs Intermediate Tuffs (Mudstone-dolomite) Pillowed Mafic Flows	White Crystalline Limestone/ Chert Quartz Dolomite Limestone Iron Formation Mica Schist Quartz Feldspar Gneiss
<u>CYCLE I</u>	<u>KEEWATIN</u>
Calcitic/Dolomitic Marble {Felsic / Intermediate} Pyroclastics Massive Mafic Flows 300-350 m	Schist of Submarine Origin

in the local rocks. The limestone clasts which are prominent in the Belmont Lake conglomerate are likely derived from the local rocks. Thin section study and field study has shown that these limestone clasts more closely resemble the marble underlying the conglomerates, and interbedded with them, than the marbles associated with either cycle I (calcite and dolomite with tremolite) or cycle II. Some of these marbles are also laminated and highly folded. The local source proposal is supported by the subangular shape of these limestone clasts which seems to indicate a short transport distance. The abundance of these clasts which are easily weathered also implies a local source.

But many of the rocks in the Belmont-S. Methuen T.P. area are not found in the conglomerate. Among these are the gabbro and granite intrusions and the mafic volcanics which were reported to be present as clasts in the conglomerate on Rock Is. but not conclusively identified. (Bartlett, 1980 pers. comm.) Miller and Knight (1914) did mention the presence of granite pebbles as well as quartz porphyry, and feldspar porphyry pebbles. These clast types were not seen on any of the islands studied. Likewise, several types of clasts in the conglomerate are not visible in the area as outcrop. These include the intermediate volcanic clasts (dacite and trachyte) and the quartz-feldspar porphyry pebbles. It is possible that the quartz-feldspar porphyry was eroded away so that no evidence remains or that the porphyry source lies somewhere to the immediate east, perhaps in Marmora T.P. Blue quartz grains, similar to those in the quartz-feldspar porphyry have also been found in the matrix of the conglomerate and may also indicate a more distant provenance for these clasts.

Transport Process

Characteristics of the conglomerate and associated clastics allow some details of the transport process to be made. The subangular fragments of feldspar and subrounded quartz grains imply that the matrix of the conglomerate is derived from first cycle erosion. Field data shows that the Belmont Lake conglomerate is polymodal (different clast size, poorly sorted matrix), moderately to poorly sorted and clast supported. According to Harms et al (1975) a polymodal characteristic implies that some winnowing of fines or suspension of sand and mud above the bed as well as some sorting of clasts is occurring. Frequent interbeds in the conglomerate indicate a decrease in current velocity resulting cessation of clast transport. In some cases, the velocity may be high enough that clasts within the lower limits of the pebble class may be transported producing pebbly sandstone interbeds. The dominance of normal grading in the sandstone interbeds as well as in the mudstones and siltstones indicates diminshing flow strength during deposition resulting in finer sediment being deposited (Harms et al 1975).

Environment of Deposition.

At this time it is impossible to place the Belmont Lake conglomerates into a definite depositional environment because not enough sedimentary data are available i.e. more mapping is required. Conglomerates are found in five types of environments; braided rivers, glacially influenced environments, alluvial fans, shorelines, and deep sea submarine fans (Harms et al, 1975). In addition, Walker (1975, 1977), has recently shown that conglomerates originally deposited in shallow water may subsequently be resedimented into deeper water (below storm wave base).

In the Belmont Lake area, at least three cycles of subaqueous marine volcanism and one (cycle IV) of subaerial volcanism are interspersed with clastic deposition - mudstones, siltstones, pebbly sandstones, and carbonate deposition - marbles. Bartlett (1980 pers. comm.) has indicated that the volcanic cycles may be related to an island arc system. The sequences of volcanic cycles seem to imply that there was a gradual transition to shallow water up until subaerial volcanism occurred. As stated previously, petrographic and field studies have placed the conglomerate between cycle III and IV. Thus, the stratigraphic position of the conglomerate would seem to favor a shallow water environment of deposition such as an alluvial fan. A shallow water environment might also be indicated by the association of the limestone with the conglomerate. However, the clastics associated with the conglomerate do not necessarily imply shallow water deposition. The laminations for example, in the mudstone found below the conglomerate, must not be reworked in order to be preserved. But this could occur in either shallow or deep water. Harms et al (1975) state that in many cases, the overall stratigraphic context of the conglomerate is a better interpretative tool than a particular assemblage of descriptive parameters, and this does appear to be the case here.

CHAPTER SIX

CONCLUSIONS

1. The conglomerate is polymictic and moderately to poorly storted. Clast types in the conglomerate include:

limestone
white quartz
quartz hematite sandstone
magnetite chert
black chert
red chert
banded chert
biotite-muscovite schist
quartz feldspar porphyry
trachyte) intermediate volcanics
dacite)
felsic tuff
arcosic sandstone

2. Matrix of the conglomerate is moderately sorted and contains small pebbles of intermediate volcanic and black chert clasts.

3. Provenance of the conglomerate is most likely local with the clasts derived from the cycle III volcanics and sediments.

4. Stratigraphy of the Belmont Lake clastics varies. On Birch Island, outcrop shows the section from bottom to top of interbedded siltstone and argillite, mudstone, conglomerate, interbedded pebbly sandstone and schist, and quartzose marble.

5. Depositional environment is only speculative at the present time, but the overall stratigraphic context of the conglomerate seems to favor a shallow water environment possibly an alluvial fan.

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APPENDIX

POINT COUNT DATA

APPENDIX

POINT COUNT #1.

Traverse Interval (run): 7.5 cm.
Point/Traverse: 5.0 cm.

C=	CLAST
SC=	SAME CLAST
M=	MATRIX
1,2,3,=	CLAST TYPE

RUN:	#1	#2	#3	#4	#5	#6	#7
	C1	C11	C10	M	C4b	M	M
	M	M	M	M	C2	C1	C7
	C7	C4a	M	M	SC2	M	C4a
	C4a	M	C4a	C4a	C4b	C2	M
	M	C7	C8	C1	C4b	C10	M
	M	C4a	M	C8	C4b	M	M
	M	C7	M	C11	C4b	C4a	C7
	C4a	C4a	C11	C11	C2	C4b	C7
	C3	M	C4a	C4b	C7	C1	C2
	C4a	C4b	M	C4a	C11	C4a	M
	M	M	C4b	M	M	M	C2
	C7	M	C10	M	C11	M	C1
	C10	M	M	C2	C4a	C11	SC1
	C9	C3	C4b	C11	M	M	C11
	C7	C4b	M	M	C4a	M	C11
	M	M	M	M	C4b	C4b	C4a
	M	C7	C4b	M	M	C2	C4a
	C3	SC7	C4a	C4b	C4a	SC2	M
	C3		M	M	M	SC2	C4a
					C2		

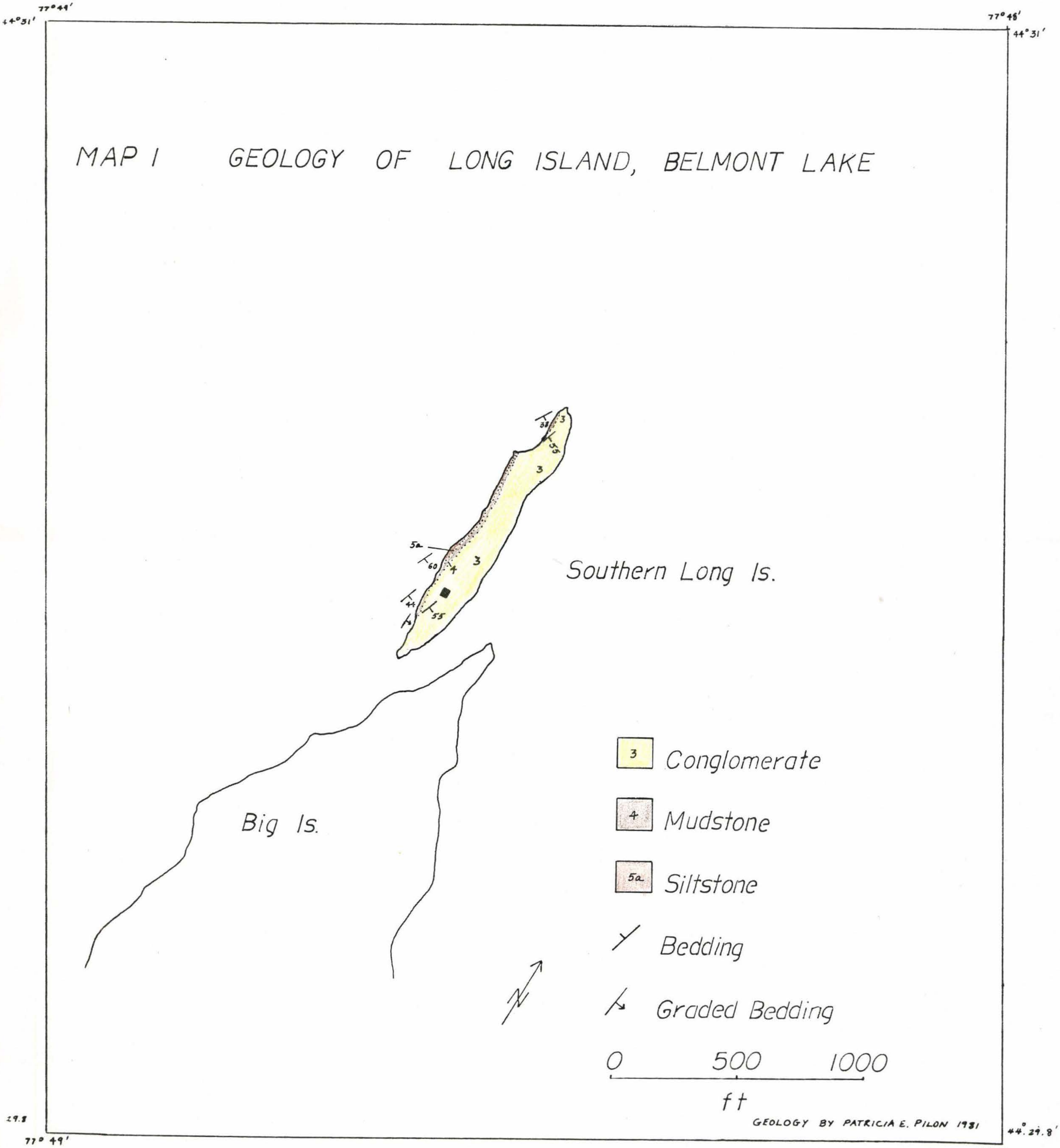
APPENDIX

POINT COUNT #2.

Traverse Interval (run): 7.5 cm.
Point/Traverse: 2.5 cm.

C=	CLAST
SC=	SAME CLAST
M=	MATRIX
1,2,3=	CLAST TYPE

RUN:	#1	#2	#3	#4	#5	#6	#7	#8	#9
	C4a	C2	C10	M	C4a	C4a	C4b	M	C7
	C4a	M	M	C4a	C4a	C4a	SC4b	C4a	M
	M	M	C4a	C4a	C4a	M	SC4b	C4a	C7
	C4a	M	M	SC4a	M	M	C4b	M	SC7
	C4a	C4a	C4b	C4a	M	C4a	M	M	SC7
	C4a	SC4a	M	M	M	M	C4b	C4a	SC7
	C2	C4a	C2	M	M	M	C4b	C4a	SC7
	C4a	M	C4b	C10	M	C4a	M	C4a	C4a
	M	C9	SC4b	SC10	M	M	M	C4a	C12
	C4a	C11	M	C4a	C4a	C12	C4b	C4a	M
	C11	SC11	M	SC4a	C4a	C12	M	M	M
	C4a	SC11	M	M	C2	M	C12	C4a	M
	C4a	SC11	M	M	C4a	M	C4b	M	C12
	M	M	M	C8	C4a	C4a	M	C4a	C4a
	M	M	M	SC8	M	M	C12	C4a	C4a
	C4a	C4b	M	C4a	C4a	C4b	SC12	C4a	C4a
	M	SC4b	M	M	SC4a	M	M	C4a	C4a
	C4a	C4b	C4b	C4a	SC4a	C4a	C12	M	C4a
	M	M	SC4b	C4a	SC4a	C4a	M	C4a	C4a
	C4a	M	C4b	C4a	C4a	M	C4a	SC4a	C4a
	C4a	C4a	M	M	C11	M	C4a	C4a	C10
	SC4a	C4a	M	M	SC11	C4a	C4a	SC4a	C4a
	M	M	M	C7	SC11	M	M	SC4a	C4a
	C4a	C1	C4b	SC7	C4a	M	C4a	C4a	
	C4a	SC1	M	C1	SC4a	M	C4a	C4a	
	C4a	SC1	C4b	SC1	M	C2	M	C3	
	M	C4a	SC4b	SC1	C4a	C7	C4a	SC3	
			C1	SC1			C12	SC3	


77°49'
44°31'
77°48'
44°31'
MAP I GEOLOGY OF LONG ISLAND, BELMONT LAKE
Southern Long Is.
Big Is.
3 Conglomerate
4 Mudstone
5a Siltstone
Bedding
Graded Bedding
N
0 500 1000
ft
GEOLOGY BY PATRICIA E. PILON 1981
29.8
77° 49'
44°29.8'
77°48'


MAP 2 GEOLOGY OF THE BELMONT LAKE CONGLOMERATE
Marys Is
Big Is.
Raft Is.
Sidonia Is.
BELMONT LAKE
Birch Is.
1 Dolomitic Marble
2 Interbedded Pebbly Sandstone & Biotite Schist
3 Conglomerate
4 Mudstone
5 Interbedded Argillite & Siltstone
Bedding
Graded bedding
Clast lineation
House
Swamp
N
0 500 1000
ft
GEOLOGY BY PATRICIA E. PILON 1981
44° 28.5'
77° 47.5'