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ONTARIO GEOLOGICAL SURVEY
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Geology of the Sharbot Lake Area, Frontenac and Lenark Counties, Southeastern Ontario

by

J.M. Wolff

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Ontario Geological Survey

OPEN FILE REPORT

SHARBOT LAKE AREA

FRONTENAC AND LANARK COUNTIES

PREFACE

In the early settlement of Ontario small scale mining operations were a significant part of general development in southeastern Ontario. However, a succession of major mineral discoveries, cheap transportation and availability of crown land gradually shifted exploration and supporting geological investigations northwards.

More recently interest in uranium, followed by upward trends in transportation costs has rekindled interest in the mineral potential of southeastern Ontario. The geology of much of the area is inadequately known for modern exploration decision purposes and mineral potential evaluation. A series of detailed geological survey projects was initiated in 1975 in the Grenville Subprovince of the Precambrian Shield in southeastern Ontario. Potential exists in the Grenville Subprovince for industrial minerals such as calcium carbonate, talc, gypsum, graphite, nepheline syenite, feldspar, marble, mica and abraisives and for precious and base metals.

E.G. Pye
Director
Ontario Geological Survey

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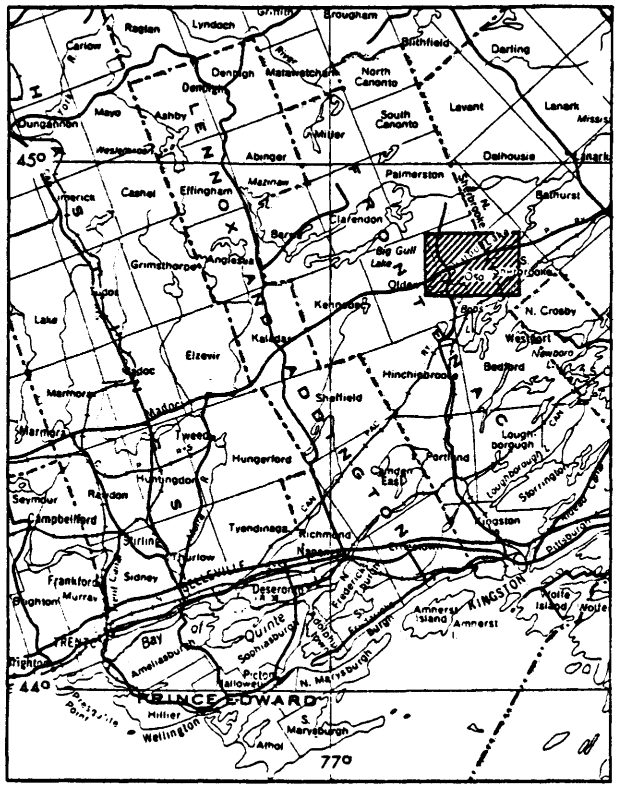

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or 1 inch to 25 miles

Key map of the Sharbot Lake Area

The Sharbot Lake map-area lies some 70 km by road north of the city of Kingston and about 105 km by road west of the city of Ottawa and covers approximately 250 sq. km.

Bedrock is of Late Precambrian age. The oldest rocks of the area are likely the high grade mafic to silicic anatectic gneisses and related migmatites and/or the metavolcanics and metasediments. The metavolcanics are mainly of a tholeiitic basalt affinity with minor intermediate calc-alkaline members. Metasediments in the map-area consist of clastic

siliceous gneisses and schists, amphibole-rich gneisses and schists, and carbonate metasediments. These appear to be derived from quartzite, quartzose-wacke, feldspathic wacke and carbonate feldspathic wackes plus carbonate sediments formed in a relatively stable basin. The high grade gneisses are granodioritic in composition, with minor amphibolite and carbonate units. They could certainly represent lower level equivalents assemblages of the metavolcanics and metasediments, although the concept that they are older basement must not be rejected.

Syntectonic intrusives in the area include the composite Northbrook Batholith (of which only the trondhjemitic portion outcrops) and the granodiorite to granite Addington Pluton.

Late tectonic intrusive rocks include the early mafic intrusive rocks, the late granitic intrusive rocks and the late mafic intrusive rocks. The early mafic intrusive rocks include the Lavant gabbro body and the Lanark-Oso anorthosite body. The first represents a high level gabbroic intrusion while the second represents a deeper level intrusion likely the residue from partial melting of a tonalitic to granodioritic gneiss assemblage, rather than the product of igneous differentiation. The late granitic intrusive rocks are chiefly granodiorite to quartz monzonite in composition and were likely derived by the partial melting of crustal material. Pegmatite dykes all have granodiorite compositions

and are considered to be a late manifestation of this granitic intrusive event. The youngest late tectonic intrusive rocks are diabase dikes.

The area is structurally divided into two different tectonic zones separated by a major shear zone exhibiting protomylonites, mylonites and mylonite gneiss. The western structural zone is the IVb Hastings Basin segment of the Central Metasedimentary Belt and only outcrops in the very northwest corner of the map-area. The bulk of the map-area is contained ithin the IVc Frontenac Axis segment and is typified by a dominant S_1 foliation which is essentially parallel to the S_0 bedding and folded into isoclinal folds (F_2) with essentially vertical plunges. Well developed quartz and hornblende rodding (L_3) and boudinage is not uncommon. Small scale deformation is best manifested in the metasedimentary units. A major healed shear zone separates medium-grade lithologies from high grade lithologies within the IVc segment. Metamorphic grade increases from the northwest corner of the map-area to the southeast. Rocks in the northwest half of the map-area have been metamorphosed within the low temperature field of medium grade metamorphism whereas those in the southeast half have assemblages indicative of the regional hypersthene zone or high grade granulite zone.

Mineral exploration in the past for gold and base metals

have been concentrated in the metavolcanic and metasedimentary rocks. The late stage granitic rocks have been the focus of exploration for phosphate, mica, feldspar and uranium. None of these ventures has so far outlined any economic deposits. Areas of current interest include potential talc deposits in the metavolcanics and feldspar in the Lanark-Oso anorthosite body.

Surficial Pleistocene deposits are most prominent in valleys associated with the major shear zones and deposits within and adjacent to the Bolton Creek Valley.

GEOLOGY OF THE SHARBOT LAKE AREA
FRONTENAC AND LENARK COUNTIES
SOUTHEASTERN ONTARIO

by

J.M. Wolff[1]

March 4/80

INTRODUCTION

The Sharbot Lake map-area lies between Latitudes 44°45'N and 44°52'30"N and Longitudes 76°30'W and 76°45'W, and is situated in Frontenac and Lanark Counties in Southern Ontario. The area covers about 250 sq. km. The village of Sharbot Lake is located in the southwest portion of the area and the village of Maberly is located in the northwest portion of the area. Sharbot Lake is

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about 70 km by road north of the city of Kingston and Maberly is about 105 km by road west of the city of Ottawa.

MINERAL EXPLORATION

Mineral exploration in the map-area has been sporadic since just before the turn of the century. The period circa 1900 saw interest in vein-type apatite deposits south of Silver Lake, and some small pyrite showings on the northeast shore of White Lake, but no economical concentrations were delineated. The second period circa 1910 saw development of some small mica and feldspar pits mainly of a prospect nature in the map-area. The third period circa 1940 saw prospecting for gold in the map-area and several pyritiferous late-stage quartz veins were prospected, three of which assayed less than 0.01 ounces of gold in selected samples (Harding, 1967). Again none of these prospects yielded economic concentrations. The fourth period of exploration circa 1959 involved exploration for base metals and gold. Although several holes were diamond drilled in metasediments at Sharbot Lake, no economical concentrations were found. The latest period of exploration activity in the map-area was from 1977-1979. The focus has been on potential uraniferous zones delineated by the joint Federal-Provincial Uranium Reconnaissance project (GSC, 1976, 1979). The zones of highest potential lie just to the north of the present map-area northwest of Clarendon Station.

PRESENT GEOLOGICAL SURVEY

Geological Map No. (back pocket, scale 1:316,80) presents the results of the geological survey carried out by the author and his assistants during the summer of 1979. Preliminary map P.+++ at a scale of 1:15,840 was released in 1980.

The field maps were prepared at the scale of 1:10,000 on base maps produced by the Cartography Unit, Ministry of Natural Resources from the National Topographic Series, provisional map 31 C/15 (scale 1:50,000). Field data were plotted on acetate overlays on vertical air photographs at the same scale as the base maps. These 1:10,000 maps were the machine reduced to 1:15,840. The data was primarily collected along pace and compass traverse lines run at right-angles to strike, approximately 400 to 500 m apart. In areas of poor outcrop, traverses were run between outcrops, visible on the air photos. In areas of massive outcrop (ie. map units 1 and 8) only areas examined in some degree of detail are outlined on the map. Data was also collected from roadcuts in the area. Samples from map units 6, 7, 8 and 9 were cut and stained for K-feldspar in the field to accurately identify the feldspar composition in these rock types.

ACKNOWLEDGEMENTS

The author was assisted in the field by A.G. Choudhry, A.E. Heagy, S. Trueman and J.E. Mountjoy. Mr. Choudhry as senior assistant carried out independent traverses throughout the field season. Discussions with K. Ford of the Geological Survey of Canada concerning the relationship between the results of medium altitude gamma ray spectrometry surveys and associated geology proved most helpful during the field season.

Except where otherwise stated, all chemical analyses that

appear in this report were done by the Geoscience Laboratory of the Ontario Geological Survey.

ACCESS

Access to the map-area is excellent. Provincial Highways Nos. 7, 38 and 509 transect the map-area east-west and north-south. Stemming from these arteries are a number of north-south and east-west secondary roads. Lake access in the western portion of the area, especially by Sharbot Lake and White Lake is good. In the eastern part of the map-area Silver Lake, Deer lake and Rock Lake in particular, although isolated, locally contain good exposures. Portions of the Fall River also contain some outcrops. An abnadoned railway bed (formerly belonging to the C.P.R. and presently a Bell Canada underground communication line) essentially parallels much of Highway 7 except near Sharbot Lake where it passes south of the western portion of the lake. The current main line of the C.P.R. passes through the southeast porton of the map-area and provided access to otherwise relatively remote areas.

PREVIOUS GEOLOGICAL WORK

The earliest recorded geological survey in the Sharbot Lake map-area is that of Murray (1852), who under the direction of William Logan, reported examining the rocks in Oso and Olden Townships. Murray identified the rocks of the "Metamorphic Series" (Laurentian Series) but did not attempt to subdivide them further. H.G. Vennor (1872) describes rocks found in Olden and Oso Townships as both sedimentary and igneous types. J. White

(1893) traced a mass of limestone eastward from Olden into Oso Township. R.W. Ells (1901) shows the geology of parts of Olden and Oso Townships on Map No. 789.

The work of Harding (1947) is the prominent geological survey in the map-area prior to the present study. Harding assigned the metasediments in the map-area to the Grenville Series and realized the distinction between older mafic intrusive rocks and somewhat younger granites and gneisses.

The present study area was included in the regional compilation of the Madoc-Gananoque Area (Hewitt, 1964). The Long Lake area and the Kaladar Area immediately adjacent and to the southwest were mapped by the author in 1978 and 1977 repsectively. The Tichbourne Area which is located immediately to the south of the present study area was mapped by Wynne-Edwards (1964). These latter three works should be consulted for pertinent data relavent to rocks found in the present study area.

TOPOGRAPHY AND DRAINAGE

Elevations in the map-area range from 163 m above sea level at Bolingbroke to 255 m in the higher portions of the Lavant gabbro body east of Highway 509 in the northwest part of the map-area. The maximum relief is about 45 m and found at the contacts of the Lavant gabbro, especially in the vicinity of Bolton Creek. The bulk of the map-area is of low relief and represents a highland area between the Tay River drainage system on the south and the Mississippi River drainage system to the north. Sharbot Lake is drained by the Fall River which flows northeasterly and meets the

Mississippi River northeast of the map-area.

GENERAL GEOLOGY

TERMINOLOGY

In order to avoid confusion with past authors a number of terms used in the discussion of the general geology are defined below. The reader should consult the geology of the Kaladar Area (Wolff, 1978) for the definition of the following terms: Precambrian Time Scale; Foliation, Schistosity, Gneissosity, Cleavage; Metamorphic Grade, Isograd and Isoreaction-Grad. In addition the reader should consult the geology of the Long Lake Area (Wolff, 1979) for the definition of the terms; Protomylonite, Mylonite, Mylonite Gneiss; Gabbro, Anorthositic Gabbro, Gabbroic Anorthosite and Anorthosite; Granolite and Granoblastite.

MIGMATITE, METATEXITE, DIATEXITE, ANATEXIS, LEUCOSOME, MELANOSOME, SOROMATITIC, SCHLIEREN, AND NEBULITIC

Migmatite terminology is taken after Mehnert (1971). Migmatite is used to describe a megascopically composite rock consisting of two or more petrographically different parts, one is the country rock in a more or less metamorphic stage and the other is of pegmatitic, aplitic, granitic, or generally plutonitic appearance. Metatexite refers to a rock which is formed by metatexis the partial, differential or selective anatexis the melting of rock of the low-melting components of a rock (generally quartz and feldspar). Diatexite refers to a rock which is formed by diatexis high-grade anatexis which includes the mafic minerals. Leucosome refers to the leucocratic part of a migmatite, generally rich in quartz and feldspar. Melanosome signifies the melanocratic part of a migmatite, rich in mafic minerals. Stromatitic is a modifier which describes those migmatites with a layered structure or stroma. Schlieren is used to describe irregular streaks or masses with blended outlines in migmatites or hybrid migmatites. Nebulitic is a modifier which describes those migmatites with ghost-like relics of pre-existing rocks. Readers not familiar with any of the above descriptors or find them difficult to distinguish from terms with similiar connotations are encouraged to consult Mehnert's text for more detailed descriptions and illustrations.

GEOLOGICAL SUMMARY

The map-area lies within the Central Metasedimentary Belt, as defined by Wynne-Edwards (1972). Specifically, the area is mainly located within the IVc Frontenac Axis segment, however the very northwest corner belongs to the IVb Hastings Basin segment. Prime units present are mafic to silicic anatectic gneisses and related migmatites, metasediments and metavolcanics of Late Precambrian age, (Grenville Supergroup equivalents), and Late Precambrian felsic and mafic intrusive bodies. Late tectonic pegmatite dykes and irregular masses cut the supracrustal rocks locally. The general succession of the rocks is given in Table 1.

Certainly the most highly metamorphosed and possibly the oldest rocks in the map-area are the mafic to silicic anatectic gneisses and related migmatites of map-unit 1. These rocks contain metatexites and diatexites plus quartzo-feldspathic gneisses which have undergone partial melting. The bulk of these rocks are essentially granodioritic in composition and could represent lower crustal equivalents of the metasedimentary and metavolcanic rocks described below, with which they are in fault contact.

The metavolcanics and metasediments occur in the northwestern part of the map-area and are confined to a zone bounded by major shear zones to the northwest and southeast. Although similar in some regards to the metasediments and metavolcanics of the Clare River Synform these rocks represent a distinct and separate entity not to be confused with the Clare River structure. The metavolcanics appear to be tholeiitic basalt which tends to be subalkalic and minor calc-alkaline rhyodacite. Although similar in composition it is difficult to correlate these rocks directly with metavolcanics of the Hermon Group as defined by Lumbers (1969); rocks more directly on strike with these metavolcanics were simply assigned as "Grenville Series" by Wynne-Edwards (1964). The metasediments of the map-area are composed of hornblende rich gneisses and schists (hornblende, plagioclase $\pm$ quartz), carbonate metasediments (calcite, dolomite, and calc-silicate bearing phases) and clastic siliceous gneisses (quartz and feldspar plus biotite-muscovite). The hornblende rich gneisses and schists represent mature calcareous sediments which under metamorphism formed hornblende creating hornblende plagioclase biotite gneisses. The clastic siliceous gneisses have quartzite to quartzose wacke to feldspathic wacke to carbonate-bearing feldspathic wacke compositions. The carbonate metasediments include a large part of the area exposed by metasediments. The carbonates are suggestive of a stable carbonate basin which was at least in part concurrent with less stable sediment deposition evidence by the presence of carbonate minerals in the clastic siliceous and amphibole-rich metasediments. Minor stability fluxes in the carbonate bank are evidenced by discontinuous fragmental marbles.

The intrusive rocks in the map-area can be grouped into two tectonic groups syntectonic and late tectonic and two compositional groups: mafic and felsic (granitic). The syntectonic intrusives are felsic and include the Northbrook Batholith and the Addington Pluton located in the northwestern corner of the map-area. The Northbrook Batholith is a composite batholith containing trondhjemite to granite compositions (Wolff, 1978, 1979), but is chiefly trondhjemite in the present map-area. The Addington Pluton is granodiorite to granite in composition but chiefly quartz monzonite, and often displays a lit-par-lit relationship with the supracrustals it intrudes. The late tectonic intrusions are of mafic and granitic compositions. The mafic intrusives include large expanses of gabbroic and anorthositic bodies and very late stage diabase dykes. The main gabbroic body is the Lavant gabbro (northern gabbro body) which ranges from gabbro to anorthositic gabbro in composition and appears to be a high-level gabbroic intrusion. Smaller gabbro bodies are associated with the Lanark-Oso mafic intrusion which is primarily anorthosite to gabbroic anorthosite with little gabbro. This anorthosite body appears not only to be a deeper level intrusive but possibly the result of anatexis rather than igneous differentiation. Specifically it may represent the residium after melting 75 percent of a granodioritic (tonalite) gneiss of appropriate composition. The granitic intrusions of the late tectonic stage are chiefly granodiorite to quartz monzonite in composition with local syenite phase, and pegmatitic granodiorite dykes. These rocks are very late stage intruding along existing major shear zones and fracture systems. These late stage granitic rocks are very similar to the MacLean Granitic Pluton in the Long Lake Area (Wolff, 1979) and similarly likely represent the partial melt derived from crustal assemblages.

The rocks in the map-area underwent regional metamorphism during the Late Precambrian. The metasediments and metavolcanic rocks have been metamorphosed to the low temperature field of medium grade metamorphism (Winkler, 1976). Assemblages in the high grade gneisses are indicative of the regional hypersthene zone or high grade granolite zone as described by Winkler (1976), and that pressures in this zone are somewhat higher than those within this similar zone in the Long Lake Area (Wolff, 1979).

Structurally, the map-area is composed of essentially two entities segmented by a major shear zone, trending north-north-east, located in the northwest corner of the map-area, which separates the IVb segment from the IVc segment of the Central Metasedimentary belt. Another northeast trending shear zone in the central part of the area separates the medium grade gneisses from the high grade gneisses and is located in the south-east-central part of the map-area. Rocks within these shear zones are typically protomylonites and mylonites. The foliation within the supracrustal rocks is considered to be an S_1 foliation which is essentially parallel to the S_0 bedding. These units are folded into isoclinal folds (F_2) with essential vertical plunge. A well developed L_3 lineations (Quartz and hornblende rodding) along the dip direction of beds is found. Boudinage is common in the metasedimentary units and combined with rodding produces pseudo-conglomerate phenomena. Late stage jointing has developed two major vertical joint sets (southeast-northwest, and north-south) with a minor horizontal set.

LATE PRECAMBRIAN

MAFIC TO SILICIC MIGMATITES AND ANATECTIC GNEISSES

Map unit 1 is composed of mafic to silicic migmatites and anatectic gneisses. Rocks of this unit are among the best exposed in the map area (locally reaching 80% exposure) and cover approximately 75 sq. km or 30 percent of the map-area. Geographically, these rocks outcrop on the eastern part of Sharbot Lake with the western contact of this unit occurring in Cranberry Bay and just west of Hawley Bay. These rocks strike north-north-east over a distance of 6.5 km where the strike changes to northeast (near the benchmark coined Ungava) and continues for another 11.3 km through the village of Maberly and eastward out of the map-area approximately 1.2 km north of Highway

7, north of McGowan Lake. With the exception of some carbonate metasedimentary units (map unit 4) and the Lanark-Oso anorthosite massif (map unit 8) and late Granitic Intrusive Rocks (map unit 9), this map unit comprises the entire southwestern portion of the map-area. As a general rule the northwestern contact of this map unit (outlined geographically above) is in contact with rocks of map unit 9, although metasedimentary lenses or slices of map units 3 and 4 can locally be found along this contact, surrounded by map unit 1 material. The most commonly occurring rock types of this map unit are map units 1a, 1b, 1c, and 1d. The other rock types are found outcropping less often, but map unit 1e is perhaps the most striking in appearance.

Map unit 1a represents medium to coarse-grained granodiorite gneiss which locally contain augens of plagioclase feldspar and contains inclusions and schlieren of map unit 1b. This rock weathers a distinctive grey with a steel grey to purplish lustre in he fresh surface, and contains dark streaks of inclusions and schlieren giving it an appearance similar to a nebulite. Table 2 reveals the modal abundances of two granodiorite samples of this unit and the modal abundance of a sample of schlieren. Note that samples M606-79-1 and M606-79-2 come from the same outcrop. The granodiorite phases typically contain 35-65 percent quartz, 10-25 percent plagioclase (sericitized oligoclase), and 15-25 percent biotite as the major phases. Minor phases include diopside, muscovite and opaques (pyrite) ranging from 5-10 percent in abundance. Grain size ranges from 0.5 mm to 4.0 mm with augens of oligoclase reaching a maximum length of 8.0 mm. Textures in this unit are primarily idioblastic with augeniferous zones. These augen-bearing zones in themselves represent protomylonites with some samples displaying fine ribbons of recrystallized quartz (see Photo 1). Such augen-bearing zones are concentrated near the north-western contact of this unit. The mafic schlieren found in this unit contain 45 percent plagioclase (oligoclase), 34 percent hornblende, 9 percent biotite and 12 percent opaques (pyrite). Textures tend to be granoblastic to idioblastic with grain sizes ranging between 1.0 mm and 4.0 mm. Mineralogically, these schlieren phases are very similar to map unit 1b. Typically the schlieren are 10 cm in width and up to 5 m along strike.

Map unit 1b is used to describe medium- to coarse-grained hornblende, plagioclase (labradorite), pyroxene diatexite, usually displaying plagioclase augens and/or a stromatic texture. This rock weathers a dark green with well defined but discontinuous grey-greenish-white stroma. Table 2 indicates that the major mineral phases of this unit are hornblende (25 to 35 percent), plagioclase (oligoclase-labradorite) (30-35 percent) and biotite (10-25 percent). Quartz is generally absent but if present may reach 10 percent. Diopside tends to be omnipresent but in low concentrations (less than 5 percent). Opaques are typically pyrite and constitute 10 percent of the rock. Grain size ranges from 0.5 mm to 3.0 mm with augens of quartz and plagioclase reaching 8.0 mm maximum. Similar to map unit 1a the augen-bearing phases are most dominant near the north-western contact of this unit and represent protomylonites. Typical textures of this unit are idioblastic. This mafic portion represents approximately 90 percent of the stroma. The felsic portion is fine-grained to medium-grained granodiorite with a granoblastic texture.

Map unit 1c represents a fine-grained quartz-feldspar-rich gneiss ± biotite ± pyrite. This unit is distinctive in outcrop as it weathers a white to dirty white and if pyrite is present it weathers a distinctive rusty white. Although mineralogy tends to be quite variable in this unit the total quartz plus feldspar content is greater than 50 percent and often greater than 70 percent. Plagioclase is usually labradorite. The variable mineral phases include biotite, hornblende, diopside, muscovite, sphene, and pyrite (see Table 2). Grain size ranges from 0.1 mm to 2.5 mm. Textures are typically granoblastic, however, locally sheared phases of this unit contain excellent cataclastic textures indicative of protomylonites. Such cataclastic textures include recrystallized quartz ribbons with resistent plagioclase and/or orthoclase grains. The lack of mafic mineral concentrations in this unit gives it an appearance that is not typical of classical differentiated migmatites.

Map unit 1d represents a commonly occurring gneiss typically associated with map unit 1c. Map unit 1d is a medium-grained quartz, plagioclase biotite pyroxene garnet gneiss. This unit differs from unit 1c in that biotite is omnipresent and it is medium-grained. The dominant mineral phases are quartz (35-45 pecent), plagioclase (oligoclase) (20-30 percent) and biotite (10 percent). Minor phases include epidote, muscovite diopside and magnetite. Garnet is locally heavily concentrated in these units (as typified by a garnetiferous rich sample in Table 2). Rocks of this unit contain a well developed foliation-gneissosity and display a granoblastic to porphyroblastic texture. Grain size varies from 0.5 mm to 4.0 mm with garnet porphyroblasts typically reaching 7.5 mm. Both map units 1c and 1d appear to be gneisses of unquestionable metasedimentary origin based both on texture and mineralogy, and do not appear to have undergone anatexis to the same degree as other rock types in unit 1. The lack of mafic material in these rock types has impeded the development of classical differentiated migmatites.

Map unit 1e is only locally developed but a very striking rock type, and is described as a well differentiated migmatite containing a fine to medium grained leucosome of quartz and feldspar and a fine to medium grained melanosome of hornblende and plagioclase ± biotite. This rock type displays a distinctive stromatitic structure and is a good example of a metatexite weathering in alternating bands of pink-white and dark-green black. Outcrops of this rock type are very limited and are confined to areas close to the northwest contact of unit 1 with map-unit 9. An excellent exposure of this rock type occurs on the west side of Lanark County Bi-Way #4 in the village of Maberly between Highway #7 and the south Sherbrooke Township garage. The modal abundances of two samples of the leucosome and one sample of the melanosome are given in Table 2. The leucosome contains quartz (35-60 percent), plagioclase (labradorite) (20-30 percent), and biotite (8-23 percent) as the major phases. Hornblende, if present, does not exceed 10 percent. Opaques are typically 10 percent and include both pyrite and magnetite. In general these rocks have an idioblastic texture and are aplitic. The melanosome contains hornblende as the major phase (56 percent) plus plagioclase (labradorite) (18 percent) and biotite (12 percent). Minor phases are quartz (8 percent) and pyrite (6 percent). The texture is similarly idioblastic and are generally aplitic. Both the leucosome and melanosome occur repeatedly across strike and vary from 5 cm in thickness to 20 cm in thickness and are continuous along strike on an outcrop scale.

Map unit 1f represents medium-grained quartz, plagioclase, biotite, hornblende, pyroxene, syenitic to granodioritic diatexite displaying locally a poorly defined stromatitic structure. This rock type differs from unit 1a in that it usually weathers pink (syenitic phases) to greyish (granodioritic phases) with apple green streaks or wisps of epidote. Where this rock type is augen-bering the epidote is deformed around the augens. A syenitic phase was sampled and the modal abundances (Table 2) are orthoclase 30 percent, epidote 35 percent, augite 12 percent, plagioclase (labradorite) 8 percent, and pyrite 15 percent. Grain size is typically 1.0 mm to 4.0 mm and the texture is granoblastic to augen-bearing, the latter representing protomylonite phases. Excellent exposures of this rock type can be found on the west side of the cottage road which runs to Antoine Point on the southwest side Starbot Lake (reached via Shibley Road off Highway #38 south of the map-area).

Map unit 1g is a poorly developed unit and consists of medium-grained gabbroic gneiss ± biotite ± hornblende. It weathers a dark green colour and outcrops with gabbro of map unit 8 in the southeastern corner of the map-area where the Canadian Pacific Railway and Lanark County Bi-Way #4 meet north of the Tay River. Dominant mineral phases include plagioclase and pyroxene. This unit usually contains pyrite and biotite and hornblende as minor phases. Grain sizes range from 1.0 mm to 3.0 mm. Outcrops of this unit are usually poorly exposed except along rail cuts.

Map unit 1h represents pegmatoid leucosome segregations paralleling gneissosity. These segregations are typically of quartz, plagioclase and K-feldspar and contain few, if any, inclusions. Contacts are usually abrupt but diffuse and often books of biotite are concentrated along the contacts with the adjacent rocks. Whether or not these pegmatoid leucosomes are different in source and origin than the pegmatites of the late granitic intrusive rocks (map unit 9) is dubious, but the diffuse nature of the contacts suggests the country rocks were not completely cool when the pegmatoid leucosome was formed.

METASEDIMENTS AND METAVOLCANICS

MAFIC TO INTERMEDIATE METAVOLCANICS

Map unit 2 is comprised of rocks which are essentially mafic to intermediate metavolcanics with minor amounts of intercalated metasedimentary material (map units 3, 4 and 5). Rocks of this unit outcrop south and west of the hamlet of Clarendon Station and west of Highway 509. No rocks of map unit 2 occur west of the major shear passing through Clarendon Station. This map unit is bounded to the south by carbonate metasediments (map unit 4) and late-stage granitic intrusive rocks of map unit 9 and to the east by a narrow zone of carbonate metasediments adjacent to the Lavant Mafic Intrusion (map unit 8). This map unit is similar to the mafic to intermediate metavolcanic rocks in the Long Lake Area (Wolff, 1979) and occupy the same structural position as metavolcanics in the Long Lake Area.

The most abundantly occurring rock type of this unit is map unit 2a, a foliated subidioblastic fine grained quartz, epidote, plagioclase, hornblende ± chlorite amphibolite and amphibolite gneiss. These rocks weather a green grey to dark green colour in outcrop with a colour index of 35. The grain size is typically 0.1 mm to 0.2 mm with some hornblende grains as large as 0.6 mm. This mineralogy of this unit is given in Table 3. Subhedral to anhedral hornblende is the dominant mineral phase and plagioclase is usually heavily sericitized. Common accessory minerals are biotite, chlorite, quartz, calcite and sphene. Occassionally, phases of map unit 2a display prominent concentrations of epidote. In such phases the dominant mineral phases are subhedral to anhedral plagioclase (heavily sericitized) and epidote. Typical grain sizes of both mineral phases are 0.1 mm to 0.2 mm but glomeroporphyroblasts of epidote are typically 1.0 mm to 2.0 mm. Accessory minerals in this rock type are chlorite, quartz and pyrite. Since a few crystal faces are preserved, the grains are described as sub-idioblastic but the texture is granoblastic and generally equigranular with rare glomeroporphyroblasts.

Map unit 2b contains rocks rih in hornblende and weather a dark green in colour. The colour index is 35 and these rocks are more dense than those of unit 2a. Table 3 depicts the modal abundance of a sample of map unit 2b. Usually, the proportion of hornblende is higher than in this sample (45-50 percent plus) however, gradations between map uit 2a and 2b are common as the two units grade into one another both along and across strike. The grain size is medium grained (3.0 mm) for the hornblende constituent which is surrounded by a fine grained matrix (0.1 mm to 0.2 mm) of plagioclase (oligoclase), hornblende, quartz and pyrite epidote. This rock typically has a knobby appearance in outcrop.

Map unit 2c is composed of intermediate metavolcanic rocks. These are fine grained (0.1 mm to 0.2 mm) and weather a buff grey colour in the field. The colour index is 15-30 and the mineralogy is principally quartz and plagioclase (heavily sericitized), accounting for 40-50 percent of the rock. The remainder is equally divided between hornblende, biotite, epidote and pyrite. The grains are subidioblastic in thin section creating a granoblastic texture. In hand specimen the fine grained nature and mineralogy are suggestive of a meta-ash tuff, although this is complicated by the shearing and epidotization that this rock type has undergone. This rock type is rare and is discontinuous along strike.

Map unit 2d represents fine-grained talc, tremolite and calcite schist. This rock unit weathers a streaky grey to green and white with a distinctive pearly lustre where well exposed, more typically it is covered by thick accumulations of vegetation. This unit is fine-grained (0.5 mm to 1.0 mm) and schistose. Table 3 indicates the modal abundance dominated by talc and plagioclase, with minor amounts of tremolite, pyrite and limonite. The particular sample examined contained no calcite as it was selectively chosen to concentrate on the talc bearing phases. Comparison of this unit and one several kilometers north of the map-area near Robertsville by the author during the field season revealed similarities in size, texture and mineralogy. Talc-tremolite (see Economic Geology Section) from the Robertsville unit is currently being extracted by RAM Petroleum Ltd.

The majority of the strike length of map unit 2 in the map-area is bounded on the west by the major shear zone which underlies the hamlet of Clarendon Station. Many of the units described above display shear strain features associated with this shear zone because of their close proximity to the zone. Shear strain features in map unit 2 are coded as 2e and any samples examined did not display any textures indicative of shearing intensity beyond that of protomylonite (see Photo 2). Those units of map unit 2, which have been strained typically display chlorite in their modes and if epidote was present it illustrates strain features on a grain to grain basis chiefly by the parallel alignment of the long ones of individual grains. This chlorite and epidote mineralogy is also typical of the mafic to intermediate metavolcanic units in the Long Lake area where they have suffered shearing strain deformafion immediately adjacent to the major shear zone which underlies through the village of Mountain Grove (Wolff, 1979).

Due to the sheared and altered nature of the rocks belonging to map unit 2, it is difficult to compare these rocks above with the Tudor metavolcanics texturally or mineralogically, and chemical analysis would be tenuous. This unit, however, can be closely compared mineralogically, texturally, and structurally with those mafic to intermediate metavolcanics of the Long Lake Area (Wolff, 1979). To the extent that the Long Lake Area metavolcanics are similar to the Tudor metavolcanics, the author thereby suggests that the metavolcanic units of map unit 2 in the Sharbot Lake area may also be similar to the Tudor suite.

CLASTIC SILICEOUS GNEISSES AND SCHISTS

Map unit 3 is comprised of clastic siliceous gneisses and schists which outcrop in the belt of metasediments that extends from the southwest corner of the map-area, through Sharbot Lake where the strike changes to northeast and thence eastward north of Silver Lake. Rocks of this unit are intercalated with those of map units 4 and 5 and are intruded by discontinuous sills and/or subparallel dykes of pegmatite of unit 9. Dominant outcroppings of map unit 3 occur on the shores of Sharbot Lake and along

Highway 7 just south of White Lake. Map unit 3 is bounded to the north by map unit 9, 8, and 4 and to the south by map units 9 and 1. Rocks of map unit 3 display a weak to well developed foliation, minor pinch and swell structures, minor fold structures and distinct brittle fracture and rodding phenomena.

The three most abundant rock types of map unit 3 are 3a, 3b and 3c. Map unit 3a is a foliated, granoblastic, fine to medium-grained, biotite-quartzo-feldspathic paragneiss. This map unit weathers to a whitish grey-buff with rusty weathering of the biotite. The biotitic and quartzo-feldspathic layers define the compositional layering and the biotite defines the perferred mineral orientation. The layering is generally 1 cm plus in thickness. There is much repetition of this rock type across strike on an outcrop scale. Discontinuous garnetiferous horizons are locally present. The grain size ranges from 0.1 mm to 2.0 mm and the texture is well foliated granoblastic with garnetiferous varieties being poikiloblastic. Modal abundances in this map unit are typically quartz 30-60 percent, plagioclase (andesine) 10-45 percent and biotite 10-25 percent. Hornblende, almandine garnet, muscovite, epidote and tourmaline are accessory and opaques are either pyrite or Fe oxide. This rock type likely represents a metamorphosed feldspathic wacke.

Map unit 3b has a similar mode of occurrence as that of 3a, and often occurrs on the same outcropping as map unit 3a. Map unit 3b is a foliated, granoblastic, fine to medium grained biotite-hornblende-plagioclase-quartz paragneiss. This map unit weathers a streaked greenish-grey colour. The biotite-hornblende and plagioclase-quartz layers define the compositional layering with the mafic component defining the preferred mineral orientation. The layering is generally 1 m plus in thickness. The grain size varies from 0.1 mm to 2.0 mm and the texture is well foliated granoblastic. Local garnet-bearing phases commonly display poikiloblastic textures. Table 4 summarizes the mineral abundances of this rock type. It should be noted that quartz is usually 10-25 percent, plagioclase (sericitized andesine) 10-20 percent, hornblende 25-35 percent, and biotite 10-20 percent. Accessory minerals are calcite, apatite, tremolite, and talc. Opaques are generally limited to pyrite and Fe-oxide. This rock type likely represents a metamorphosed cabonate-bearing feldspathic wacke.

Map unit 3c has two chief modes of occurrence; as thin (5 cm thick) discontinuous layers within map units 3a, and 3b; and as discrete thick (outcrop scale) lenses within the metasedimentary sequence. Map unit 3c is defined as a fine-grained banded quartzite with accessory biotite, muscovite and feldspar. This unit weathers a distinctive white to white-grey colour. The banding or layering is defined by biotite and/or muscovite where these platy minerals are present, and often by subtle grain size difference across layers. Layering generally ranges from 0.5 cm to 2 cm in thickness. Grain sizes of all minerals present range from 0.1 mm to 0.2 mm and the texture is granoblastic. Table 4 illustrates the modal abundances of map unit 3c. Quartz is the most abundant mineral and varies from 70-80 percent, and biotite or muscovite 15-25 percent. Accessories include plagioclase, microcline, calcite and pyrite none of which exceed 5 percent. Locally, when map unit 3c occurs as thin layers within map unts 3a or 3b the 3c phases occur as severely rodded and segmented blocks. These brittle fracture and dip-slip shearing phenomena create structures which appear to be not unlike meta-conglomerate units. When traced along strike however, these blocks become continuous quartzite layers and lenses representing continuous beds and not pebbles perhaps representative of regional unconformities and uplift.

Map unit 3d is a foliated granoblastic fine grained to medium grained epidote, biotite, K-feldspar, plagioclase, quartz paragneiss. This rock type weathers a buff-grey to pinkish-grey with green streaks. It has been separated as a different rock type because of its small amount of biotite (<10 percent), but near equal amounts of quartz (40-50 percent), and total feldspar (30-40 percent), plus prominent amounts of epidote (5-10 percent). The grain size is (0.1 mm to 1.0 mm). Layering is weakly defined and the texture is granoblasti with a well developed foliation. The plagioclase is usually saussuritized andesine and K-feldspar is well preserved microcline. Minor phases are anhedral rutile and opaques.

Significant modifers to the above units especially map unit 3a have been included in the code. Map unit 3e represents pyritic varieties. Pyrite may reach proportions of 33 percent but the high degree of weathering creates massive rusty staining on the weathered surface. Map unit 3f is used to delineate those phases of map units 3a and 3c which contain significant amounts of muscovite. When this code is employed the muscovite content is usually between 25 and 40 percent of the rock and in outcrop occurs as discrete muscovite layers producing upon exfoliation massive surfaces of muscovite.

Locally within map unit 3 aluminous schists are found, containing muscovite (<50 percent) and quartz (20-35 percent) as the major mineral phase and plagioclase, epidote, almandine garnet and magnetite as minor mineral phases. This rock type is discontinuous along strike and is represented by map unit 3g.

Map unit 3h represents foliated fine to medium grained biotite, calcite, quartzo-feldspathic paragneiss which is locally schistose. In short, this rock type can be considered as a calcitic variety of 3a. Because of the proportion of biotite and calcite present and the contrasting competencies of these minerals to the quartzo-feldspathic component of this rock it is usually schistose, and grades across and along strike into map units 3a.

Map units 3a, 3b, and 3d above are locally garnetiferous, and delineated so by map unit 3i. Invariably the garnet is almandine and poikiloblastic. No rotational or rotated garnets were observed in this map-unit.

Those rocks of map unit 3 which occur within or bordering the major shear zone which underlies the hamlet of Clarendon Station are described by map unit 3j. The high shearing stresses have created local protomylonites and mylonites with only local mylonitic gneiss. A thin sectioned sample contained 26 percent quartz, 37 percent plagioclase (sericitized andesine), 28 percent biotite, and less than 5 percent of each of the following; apatite, calcite and pyrite. The rock was fine grained 0.5 mm to 2.0 mm with the quartz grains being strained and elongated and locally displaying mortar texture. In outcrop these rocks show high shear strain features typical of dynamically metamorphosed rocks, as described by Spry (1969).

Map unit 3k is a leucocratic foliated granoblastic fine grained biotite, magnetite, muscovite, quartzo-feldspathic gneiss. This unit is very fine grained (<0.5 mm) hence it is often difficult to detect any layering except on close examination of the weathered surface which reveals very thin laminations (<0.5 mm). In hand specimen magnetite can be found in these laminations. The dominant mineral phases are quartz, plagioclase (andesine, highly sericitized) K-feldspar (microcline and orthoclase), muscovite and biotite. Minor phases are magnetite and zircon. Texturally, these rocks are granoblastic to granoblastic polygonal with quartz grains displaying interlocking textures. The fine grained and thinly laminated nature of this unit implies that this rock type may be in part a volcanogenic sediment, perhaps representing recrystallized varieties of andesitic and rhyolitic to rhyodacitic tuffs. This unit is not abundant in the map-area.

CARBONATE METASEDIMENTS

Map unit 4 is composed of carbonate metasediments. The dominant outcroppings of this unit occur in three major parts of the map-area. The first is as intercalated beds and thick units within the metasedimentary units which pass through Sharbot Lake. The second area of outcropping is a zone which stretches essentially across the entire map area from Highway 509 and the hamlet of Oso in the west to the northeast corner of the map-area north of Fagan Lake. This area of outcropping is generally quite flat and parallels Bolton Creek locally reaching 4 km in exposed width. The third zone of outcropping of this map unit is a northeast trending zone stretching from Elbow Lake (on the northeast part of Sharbot Lake) to Clear Lake. The majority of outcrops in this zone are bounded to the north by the Fall River and to the south by unit 8 (Early Mafic Intrusive Rocks) and reaches a maximum width of 0.8 km. In addition to these zones of outcropping of map unit 4, outcrops of this unit can be found within map unit 1 (Mafic to Silicic Migmatities and Anatectic Gnneisses) particularly between the village of Bolingbroke and Little Silver Lake. Rocks of map unit 4 are best exposed where farmland has been cleared, otherwise they are densely vegetated. This unit is typically highly deformed locally, exhibiting flowage type structures.

The carbonate metasediments have been divided into three main groups, calcite marble (map unit 4a), dolomite marble (map unit 4c) and dolomite-calcite marble (map unit 4d). Disseminated quartz is generally absent in the carbonate metasediments, however, local skarn phases are developed.

Map unit 4a is a white-grey weathering calcite marble. It is usually medium to coarse grained (3 mm to 5 mm) and displays a granoblastic texture. In general, this unit is quite massive. Locally this map unit possesses thin laminations (0.5 cm to 2.0 cm thick). These are quite continuous and this feature has been coded as map unit 4b (see Photo 3). The calcite rhombs are idioblastic to subidioblastic in form.

Map unit 4c represents the dolomite marble. This unit is medium grained (1 mmto 5 mm) and is quite massive displaying a granoblastic texture. This unit tends to weather more of a snow-white to blue colour. The dolomite rhombs are idioblastic to subidioblastic.

Map unit 4d is very similar to map units 4a and 4c and is really a combination of each end member. This unit has a somewhat mottled grey colour and is medium grained (1 mm to 5 mm) with a granoblastic texture. It should be noted that map units 4a, c and d can occur on the same outcrop over short distances both along and across strike and the dominant phase or phases are shown on the map. Similarly, outcrops of entirely one of the above types can be found.

The legend does not attempt to delineate between the mineralogical variations in the above rock types created by different levels of metamorphism. Several samples of high grade marbles were thin sectioned and displayed the minerals diopside, phlogopite and/or apatite present in the modes, and a general absence of dolomite. Grain sizes of the metamorphic high grade marbles was generally coarse grained as well.

The remaining map units in this category represent various mineral groupings and intercalated rock types which occur in any of the above lithologies.

Map unit 4e is used to distinguish calc-silicate mineral assemblages. Thee are fine grained (0.5 mm) to medium grained (5 mm) subidioblastic groupings of tremolite $\pm$ diopside $\pm$ talc $\pm$ apatite $\pm$ sphene. Tremolite is by far the most common calc-silicate encountered. It is green-whitish-grey in colour and occurs in randomly oriented needles and radiating bundles typically less than 2.5 cm in length. The other calc-silicates listed include diopside idioblasts which are very well preserved and are typically 5 mm in size and brownish green in colour. Talc and apatite are less common and both are green in colour and less than 1 cm in size and typically subidioblastic to idioblastic in form. Sphene is widely found in this map unit and typically subidioblastic in form.

Map unit 4f contains fragmental dolomite-calcite marble containing flags of quartzite, quartz-feldspar and calc-silicate (map unit 4e material). This map unit usually occupies a continuous horizon on the outcrop scale. The quartzite zones are medium grained (1 mm to 5 mm) and usually contain some areas of massive quartz. The contact between this material and the adjacent dolomite-calcite marble is heavily masked by pervasive calc-silicate material (map unit 4e). The formation of these calc-silicate phases occurred during the metamorphism of these units and the intermixing of carbonate and quartz-rich chemistries. The quartzite blocks and flags are separated and flowage of the carbonate material between flags is intimate. Quartzite blocks are typically 15-20 cm thick and 20-30 cm in length however, some of the quartzite beds reach 0.5 m in thickness locally. This map unit is significant in that it represents local topographic highs and instabilities in the carbonate bank during deposition (Wolff, 1978).

Map unit 4g is composed of quartzite and quartzo-feldspathic blocks, broken beds and flags. These are very different than map unit 4f in size, mineralogy and habit. In size, map unit 4g is never greater than 10-15 cm in thickness and individual grains are fine-grained (<1 mm); in mineralogy this map unit contains feldspar and appears more like clean feldspathic wacke and quartzose wackes of map unit 3; and in habit, these blocks are angular, with clear cut contacts, possess a positive relief and are essentially equidimensional and discontinuous along strike. Broken beds of this material tend to be thin (<2 cm thick) and parallel foliation in the surrounding carbonate metasediments. Photos of the habit of this map unit can be found in Wolff, 1979.

Map unit 4h represents recrystallized chert beds. These are less than 5 cm thick and discontinuous along strike.

Map unit 4l contains mafic hornblende rich segmented layers. These are typically less than 25 cm thick and discontinuous along strike. In all likelyhood these are related to map unit 5 (amphibole-rich gneisses and schists).

Map unit 4j comprises very coarse grained (2 cm) varieties of map units 4a, c, and d. Spatially these only occur in those carbonates in zones of a higher metamorphic grade. The calcite rhombs are extremely large yet idioblastic.

Map unit 4k delineates contact skarn phases containing tremolite, diopside talc and phlogopite. These units are poorly developed and although phlogopite is omnipresent any combination of the other minerals may be present. Skarn phases typically contain coarse grained calcite rhombs and fine grained to medium grained (0.5 mm to 1.5 mm) subidioblastic to idioblastic grains of diopside/talc tremolite. This map unit is usually discontinuous along strike and less than 0.5 in thickness. Often these zones are somewhat sheared.

Map unit 4L represents a calcite graphite schist. This unit is confined to those carbonte rocks intercalated with map unit 5 along Highway 509 south of Clarendon Station. Calcite in this map unit tends to be subidioblastic and fine grained to medium grained (0.1 mm to 1.0 mm) and completely surrounded by graphite. Not suprisingly this unit is quite friable, and often accompanied by disseminated pyrite.

Not included in the above code but listed on the map-are are a number of occurrences of phlogopite, graphite, and pyrite in map unit 4 rocks.

AMPHIBOLE-RICH GNEISSES AND SCHISTS

Map unit 5 is composed of amphibole-rich gneisses and schists. This unit outcrops primarily in the metasedimentary belt which passes through Sharbot Lake and the better outcrops of this unit can be found on the shores of the western part of Sharbot Lake and along the Zealand Road between Highways 38 and 7. Smaller outcrops of this unit can be found intercalated with units 2 and 4 along Highway 509 just south of Clarendon Station. Unit 5 is typically closely associated with map units 3 and 4 in the metasedimentary succession.

Map unit 5a is composed of foliated fine grained (0.5 mm) hornblende-plagioclase gneiss locally boudinaged ± biotite ± epidote ± calcite. This unit weathers greenish grey with local apple green concentrations of epidote. Modal abundances of this map unit are illustrated in Table 5. Plagioclase typically varies from 40-45 percent and varies in composition from andesine to oligoclase. Hornblende is typically 30-35 percent of the rock. Minor constituents include biotite, calcite, apatite, sphene and opaques none of which exceeds 10 percent. The texture of this unit is granoblastic with the hornblende grains being subidioblastic and along with the biotite component defining the foliation-gneissosity, and compositional layering. Locally this unit is boudinaged.

Map unit 5b represents massive, medium to coarse grained (1 mm to 7.5 mm) idioblastic amphibolite (possibly gabbro). In outcrop this is a distinctive unit as it appears to be a somewhat deformed gabbro, good examples of which can be seen along the northwestern shore of Sharbot Lake at and near the Sharbot Lake Provincial

Park. Table 5 depicts the modal abundances of two samples of this unit. The dominant mineral is hornblende which varies in abundances from 65-70 percent. The hornblende occurs both as large (7.5 mm porphyroblasts and idioblasts) and as smaller (1.0 mm) disseminations in the matrix. Plagioclase is the next abundant mineral and varies from 15 to 25 percent in abundance, and in composition from andesine to oligoclase. Minor phases include calcite, apatite and opaques (pyrite) none of which exceed 10 percent in abundance. The composition, texture and appearance of this unit in outcrop suggest it may represent a metagabbro. This unit occurs commonly in similar rocks to the southwest of the Sharbot lake area where it also appears as a metagabbro (Wolff, 1978, 1979).

Map unit 5c represents calcite porphyroblasts and/or calcite layers which ocur locally in map unit 5a. This unit weathers somewhat more of cream-green than map unit 5a and reacts to dilute HCl in the field. Table 5 shows the modal abundance of this map unit which differs from map unit 5a in its calcite content and also the presence of accessory diopside.

Occurring locally throughout map unit 5 are a number of discontinuous schist units. These units have been divided into biotite chlorite schist (map unit 5d) and biotite hornblende schist (map unit 5e). Typically, these units are composed of 50-60 percent biotite which locally forms subhedral to euhedral books up to 6 cm in size. Hornblende and chlorite comprises the remainder of these rocks respectively and is fine to medium grained (1.0 mm to 5.0 mm). Apatite and pyrite are minor phases in those two schist units.

Map unit 5f is used to define a foliated fine to medium-grained subidioblastic plagioclase, hornblende gneiss ± biotite ± epidote. This unit is essentially the same as map unit 5a but hornblende is present in greater abundance than plagioclase. Consequently, this unit weathers a greyish green with local apple green concentrations of epidote. Plagioclase compositions vary from andesine to oligoclase and minor phases include biotite, calcite, apatite, sphene and epidote. This unit grades quickly into map unit 5a both along and across strike and is included for completeness in describing variations on an outcrop scale.

Map unit 5g is a fine grained to medium grained granoblastic quartz, plagioclase, hornblende gneiss. This rock weathers a grey-whitish green, often displays a "salt and pepper" weathering and possesses a definite hornblende foliation. It differs from map unit 5a in that the granoblastic texture is clearly visible in hand specimen, and the grains appear less deformed. Mineralogically the main phases are hornblende (35-40 percent), plagioclase (20-30 percent oligolase), biotite (15-20 percent) and quartz (10-15 percent) (see Table 4). The only minor phase present is subhedral pyrite (less than 10 percent). Grain size varies from (0.1 to 1.0 mm) and well defined compositional layering and boundinage are absent in this map unit.

Map unit 5h represents foliated subidioblastic, fine to medium grained plagioclase hornblende gneiss (80 percent hornblende). This unit weathers a dark green-brownish colour and grain size ranges from 0.5 mm to 5.0 mm. Containing little plagioclase the rock has hornblende as the dominant mineral phase. Biotite and epidote are minor phases. This unit is only mappable over short distances and often associated with map units 5a, and 5f.

Map unit 5i is a foliated fine grained to medium grained K-feldspar hornblende gneiss. It is similar to map unit 5b but contains up to 20 percent K-feldspar (orthoclase). Quartz and plagioclase (albite) are also present. This unit is only mappable over short distances.

Map unit 5j is a qualifier to distinguish the presence of almandine garnet porphyroblasts in map units 5a, 5f and 5g. These garnets typically contain inclusions of quartz in thin section but no apparent rotation is noted.

In addition to the discontinuous schists delineated by map units 5d and 5e, poorly developed botite hornblende quartzo-feldspathic schists can be found and are represented by map unit 5k. Hornblende and/or biotite comprise between 50 percent and 85 percent of the rock. Quartz and plagioclase (usually heavily sericitized) each are less than 15 percent of the rock. Minor phases include apatite and epidote plus pyrite. Schists of this unit not only differ from the previous two in mineralogy but also in grain size which ranges from 0.1 to 0.3 mm.

Map unit 5L is indicative of those units described above which have been sheared and recrystallized forming protomylonites,

mylonites and mylonite gneiss. These are located adjacent to and on the eastern side of the major shear zone which passes through the hamlet of Clarendon Station. The sample thin sectioned represents a protomylonite. In hand specimen rocks of this unit are highly "stretched". In thin section the most resistant minerals to the shear stress have been the quartz, plagioclase, hornblende and almandine garnet grains. The biotite has freely flowed around the almandine garnet and hornblende grains. The quartz grains have been crushed and fracturing of the other minerals resistant to the shearing stres is common. Calcite, epidote and pyrite are minor phases in this rock type.

Whereas it can be shown in the Long Lake and Kaladar Areas that rocks of this unit are most closely affiliated with immature volcanogenic sediments (Wolff, 1978, 1979), the amphibole-rich gneisses and schists of the Sharbot Lake area are more closely associated with much more mature sediments originally containing a thin calcium carbonate content which upon metamorphism has been incorporated in the hornblende mineralogy.

SYNTECTONIC METAMORPHOSED FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

NORTHBROOK BATHOLITH

Situated in the northwest corner of the map area are a number of outcrops of the Northbrook Batholith (map unit 6). This map unit covers a very minor portion of the map-area (0.25 km^2) but a large expanse of this body occurs in the Kaladar area to the southwest and is described in some detail by Wolff (1978), and Wolff (1979).

Of the several phases of the Northbrook Batholith that exist, the only phase present in the map area is a lineated to weakly foliated, medium grained biotite trondhjemite, (map uit 6a). This unit weathers a grey-white, is medium grained (0.5 mm to 2.0 mm) and is granoblastic in texture. The principle mineral phases are plagioclase (andesine which is slightly sericitized along twin lamellae), biotite and quartz. Minor phases include muscovite, epidote, sphene and epidote. The epidote grains sometimes contain allanite cores, and muscovite needles are usually confined to plagioclase grain boundaries. It should be mentioned that this unit is cut by pink-white pegmatite dykes of map unit 9.

ADDINGTON PLUTON

Map unit 7, the Addington pluton, outcrops in the map-area in the northwest corner bounded on the west by the Northbrook Batholith and on the east by the major shear zone which passes through the hamlet of Clarendon Station. The unit reaches a maximum width of 2 km and contains discontinuous inclusions of metasedimentary material of map units 3, 4, and 5. Along the western boundary of this unit is a continuous sill or subparallel dyke of unit 9 pink-white pegmatite. This unit has been described in greater detail in the Kaladar Area (Wolff, 1978), and comparison of the body in the two areas reveal striking similarities both in mineral compositions and the lit-par-lit intrusive nature of the pluton with respect to the metasedimentary inclusions.

Map unit 7a is the most abundantly outcropping phase of the

Addington pluton in the map area. It contains foliated to gneissic, medium grained leucocratic quartz monzonite. In outcrop this unit weathers pinkish-white-colour. The grain size is typically 1.0 mm to 1.5 mm and the dominant mineral phases are quartz, plagioclase (untwinned albite), orthoclase and microcline. The plagioclase and orthoclase grains are seriticized. Muscovite is the dominant mica present acounting for 10 percent of the rock. Biotite, sphene and pyrite each seldom exceed 5 percent in the mode. The muscovite grains present display vermiform growth patterns. Texturally, this unit is granoblastic to foliated and locally gneissic.

Where map unit 7 is in close proximity to the major shear zone which passes through the hamlet of Clarendon Station map unit 7b is commonly developed. Map unit 7b consists of protomylonite; mylonite; and mylonite gneiss which contains porphyroclastic phases of quartz monzonite to granodiorite and usually containing epidote. Dominant mineral phases include quartz, plagioclase and orthoclase. Similar to map unit 7a the plagioclase is untwinned albite and both the plagioclase and the orthoclase components are sericitized. Muscovite and biotite cumulatively account for 20-25 percent of the rock. Opaques are pyrite and magnetite which account for a maximum of 10 percent of the mode. This phase is usually fine-grained (0.5 mm to 1.0 mm). The shearing stress has created dynamic metamorphism of this rock type which is evidenced by the formation of quartz ribbons paralleling the foliation-gneissosity. Muscovite is also present in trains and is best developed where the feldspar grains are adjacent to the shearing planes (represented by the quartz ribbons). Muscovite is probably formed at the complete sericitization of plagioclase and/or orthoclase as the degree of sericitization in these phases drastically increases towards the shear planes defined by the quartz ribbons. In samples where the shearing stress is somewhat less the quartz grains are strained and all quartz grains are aligned with long axes parallel to the foliation defined by muscovite and biotite mineral orientation.

Map unit 7c is used to describe a foliated to gneissic medium-grained biotite quartz monzonite with biotite less than 25 percent of the mode. In outcrop this unit weathers a brown-(rusty)-pink-white colour. The chief difference between map unit 7a and this unit is the difference in the abundance of biotite. Grain sizes in this unit range from 1.0 to 1.5 mm. The dominant mineral phases are quartz, plagioclase (untwinned albite), orthoclase and microcline. The plagioclase and orthoclase grains are seritcitized. Biotite is the dominant mica which accounts for up to 25 percent of the rock. Epidote, sphene and pyrite are the accessory minerals. Texturally, this unit is granoblastic to foliated and locally gneissic.

Map unit 7d is used to describe a weakly foliated leucocratic medium-grained pink granite which weathers a pink colour. The prime mineral phases in this rock are quartz, plagioclase (andesine), orthoclase and microcline. Biotite, epidote sphene pyrite and magnetite are minor phases. The texture of this rock is granoblastic and the rock is weakly foliated. Grain size varies from 1.0 mm to 1.5 mm.

Map unit 7e represents foliated to gneissic medium-grained, biotite granodiorite with biotite being less than 25 percent of the rock. This unit weathers a whitish grey with dark streaks (biotite). The major mineral phases are quartz and plagioclase (andesine), plus biotite. The minor mineral phases include orthoclase, epidote, pyrite and magnetite. Grain size varies from 1.0 to 1.5 mm.

EARLY MAFIC INTRUSIVE ROCKS

LAVANT AND LANARK-OSO MAFIC INTRUSIONS

Map unit 8 is used to delineate the Lavant and Lanark-Oso Mafic Intrusions. These bodies collectively range in composition from gabbro to anorthosite to pyroxenite. Each body outcrops in a different geographical and structural location in the map-area. The Lavant body is exposed mainly along the northern boundary of the map area east of Highway 509 and north of Bolton Creek, with smaller outcroppings in the carbonate metasediments immediaely adjacent to this body. The Lanark-Oso mafic intrusion outcrops in a north-east trending manner (parallel regional foliation-gneissosity) within the high-grade gneisses of unit 1 south of Highway 7. Although grouped under one map-unit these bodies contain several mineralogical differences and possibly differing petrogeneses, and may not be contemporaneous bodies.

Map uit 8a is used to describe medium to coarse grained gabbro, which possesses a colour index greater than 30. This map unit is found in both bodies and the modal abundances are given in tables 6 and 8. The major mineral phases include plagioclase (sericitized labradorite) 35-45 percent, total pyroxene 12-35 percent and hornblende absent to 50 percent. It should be noted that the pyroxene rich phases are hornblende poor and the hornblende-rich phases are pyroxene-poor; thus if the totals of hornblende and pyroxene are considered the range becomes 30-55 percent (hornblende is likely an alteration product after pyroxene in these rocks). Samples thin sectioned indicated that the pyroxene compositions varied between the Lavant and Lanark-Oso bodies. In the Lavant body augite is the clinopyroxene present and hypersthene the orthopyroxene present while the samples form the Lanark-Oso body contained diopside only. The minor mineral phases present include epidote apatite and pyrite and ilmenite in the Lavant gabbros while biotite, olivine, muscovite and pyrite and ilmenite are in the Lanark-Oso body. With the exception of epidote these mineral phases do not exceed 10 percent in abundance. These rocks typically weather a dark green to drab olive green colour and vary in grain size from 1.0 mm to 4.0 mm. Grains are usually subhedral and the texture is interlocking ith relict subophitic textures locally preserved.

Map unit 8b is medium to coarse grained anorthositic gabbro to gabbroic anorthosite which possess a colour index between 10 and 30. The anorthositic gabbro and gabbroic anorthosite phases have been grouped into one map uit becaue of the gradtional nature of these two rock types in outcrop and resultant difficulty in delineating consistently between the two types in mapping these units. This unit is present in the Lavant body but is best developed and of a more common occurrence in the Lanark-Oso body. Table 8 depicts the modal abundances of several thin sectioned samples of this rock type from the Lanark-Oso body. Plagioclase subhedra are by far the most abundant mineral phase present and range from 75 to 85 percent in concentration. The plagioclase is typically weakly sericitized and is labradorite in composition. Minor phases include diopside/enstatite absent to 13 percent and sometimes altering to hornblende, hornblende absent to 12 percent, biotite absent to 5 percent, olivine absent to 5 percent and pyrite and ilmenite absent to 5 percent. Grain size of this unit ranges from 1.0 mm to 5.0 mm and the rock weathers a green to dark green in the field. Texturally, the minerals in this unit are primarily interlocking although some subophitic textures exist.

Map unit 8c represents medium to coarse grained anorthosite with a colour index of less than 10 percent. This map unit is extremely well developed and exposed in the Lanark-Oso body and essentially absent in the Lavant body. This rock type is a greyish-greenish-pearl colour in outcrop. Table 8 illustrates the modal abundance of five samples thin sectioned of this unit. Plagioclase is the dominant mineral phase accounting for 90 percent of the rock. The composition is labradorite and individual grains are slightly to completely sericitized. Minor mineral phases present include diopside, hornblende, biotite, quartz, pyrite and ilmenite. Sample M727-79-1 is an example of a highly sericitized variety which contains 92 percent labradorite 20 percent of which is completely altered to sericite. Although this unit generally lacks any mineral alignment two types of preferred orientation exist. Within the interior of the body anorthosites like those described above contain thin (less than 1 cm thick) discontinuous (2 m maximum) concentrations of pyroxene (see Photo 4). A sample of this is depicted in M657-79-2 which mineralogically represents map unit 8b (because of the high percentage of the pyroxene component in the thin section mode). These concentrations of pyroxene usually parallel the regional foliation-gneissosity in orientation. The second type of preferred orientation within this unit occurs near the border of this body with the gneisses of map unit 1. This zone shows the development of feldspar metacrysts which are locally altered to sericite and stretched parallel to the regional foliation gneissosity which also parallels the contact of the body with the gneiss units. The altered metacrysts of plagioclase also form a weak foliation in outcrop. The grain size of map unit 8c typically ranges from 0.5 mm to 1.0 mm with metacrysts reaching 1 cm maximum, and the texture is allotriomorphic granular with local metacrysts or porphyroblasts as described above.

Aside from these minor pyroxene concentrations, the only other mineral phase present is euhedral coarse-grained corundum. These grains reach a maximum cross-section width of 2 mm and samples up to 3 mm in length were plucked from outcrops (see Photo 5). Although a greyish-purple-green colour on the fresh surface these minerals weather black in outcrop. There are definite corundum bearing and corundum free zones in outcrop as evidenced by the lack of corundum in the thin sectioned samples. Two thin sectioned samples of corundum revealed the presence of spinel associated wth the corundum. The corundum from map unit 8c showed the corundum mantled by both a spinel and opaque (possibly chromite in part) rim, and the sample from map unit 8b contained almandine garnet, spinel, corundum and magnetite $\pm$ chromite co-existing mineral phases.

Map unit 8d is medium-grained quartz gabbro. This map unit is best developed in the Lavant body and effectively absent in the Lanark-Oso body. A sample thin sectioned of this rock type showed that heavily sericitized plagioclase comprised 31 percent of the rock, hornblende 22 percent, biotite 14 percent, quartz 12 percent, microcline 8 percent and pyrite and ilmenite 8 percent. Hypersthene was the least common mineral accounting for 5 percent of the mode (see Table 6). This rock is similar to map unit 8a in weathering colour and grain size and texture, but carries quartz.

Map unit 8e is medium to coarse grained monzonite phases which are generally limited to the Lavant body. These rocks weather a greyish-green colour and are not significantly different in habit than the gabbros of map unit 8a. As illustrated in Table 4 plagioclase (sericitized oligoclase) and orthoclase form the bulk of the rock. Biotite, epidote and pyrite and ilmenite are the chief mafic components. Textures are interlocking.

Map unit 8f represents fine grained varieties of map unit 8a.

This unit is omnipresent in virtually every outcrop of the Lavant body. It weathers a darker green and occurs as streaks and irregular phases within the coarse grained and medium grained gabbros. Mineralogically this unit contains significant amounts of epidote (see Table 6). These likely represent later stage (but essentially contemporaneous) intrusions into the gabbro body at higher levels within the crust.

Map unit 8g is comprised of syenite bearing phases of the above rock types. These rocks contain both pink weathering and grey weathering K-feldspar, and are dominantly associated with the Lavant body especially where it is in close association with rocks of map unit 9 (Late Granitic Intrusive Rocks). Table 6 depicts the modal abundance of this rock type. Dominant phases are plagioclase (oligoclase-labradorite), 35 percent sericitized orhoclase (which weathers pink) 29 percent, hornblende 22 percent and minor phases of epidote 8 percent, augite 4 percent and pyrite and ilmenite 3 percent. Grains are subhedral and vary in size from 0.5 mm to 5.0 mm and the texture is allotriomorphic granular.

Map unit 8h represents the occurrence of porphyroblasts and glomeroporphyroblasts of altered pyroxene and hornblende (after pyroxene) in the above rock types, and in the case of map unit 8c the occurrence of coarse grained plagioclase grains in a medium grained anorthosite. Although the first type represent true metamorphic textures the second may not as no recrystallization is typically evident.

Map unit 8i is medium-grained biotite granodiorite to biotite trondhjemite phases occurring primarily with the Lavant body. These rocks weather a grey-white with rusty streaks and have generally abrupt contacts with the adjacent gabbro phases although diffuse contacts can be found. Plagioclase is the dominant mineral phase (see Table 7) varying from 30-40 percent and is sericitized andesine to oligoclase. K-feldspar is generally present in the form of orthoclase and varies from 10-15 percent. Biotite is omnipresent and along with optional hornblende accounts for 20-35 percent of the rock. Quartz grains are typically subhedral to anhedral and compose 15-30 percent of the mode. Minor phases are comprised of muscovite, epidote and opaques (pyrite and magnetite). Grain sizes generally range from 0.5 mm to 3.0 mm and the texture is granoblastic. Where contacts of this unit are diffuse with the surrounding gabbro the gabbro contains quartz and may reach quartz gabbro in composition (as represented by sample M144-79-2, Table 7), and can contain almandine garnet.

Map unit 8j is used to delineate aplitic granodiorite phases of map unit 8i which generally contain little biotite, have a grain size of less than 1.0 mm and weather a white color.

Map 8k is coarse-grained pyroxenite to peridotite. This map unit occurs in both the Lavant and Lanark-Oso bodies but never with the anorthositic phases of the latter. this unit weathers a dark green, is poorly developed in either body and samples are very dense. Grain size is usually 5 mm to 4 cm. The two samples of this unit thin sectioned from the Lavant body are shown in Table 5. These samples show alteration of the pyroxene to tremolite. In one the alteration is almost complete (tremolite/pyroxene 4/1) while the other has pyroxene grains with only alteration at the boundaries. Pyroxene is clinopyroxene and represents 50 to 75 percent of the rock. The other dominant mafic mineral is olivine which is absent to 30 percent in abundance. Minor phases include plagioclase (sericitized oligioclase) 8 percent, biotite absent to 8 percent, perovskite absent to 8 percent and pyrite less than 10 percent. Table 8 indicates the modal abundance of a sample of this unit from the Lanark-Oso body. The majority of the rock is composed of orthopyroxene (32 percent), hornblende (20 percent) and olivine (25 percent). Plagioclase, spinel and pyrite are major phases each present in quantities less than 10 percent.

In consideration of the above descriptions of the Lavant and Lanark-Oso bodies it becomes apparent that we are dealing with two different mafic intrusions. The Lavant is basically a gabbro body which contains fine grained gabbro phases (8f), felsic late stage intrusives (8i and 8j) and no anorthosite. Common within the body are rafts and slices of carbonate metasediment (unit 4) material. The Lavant body lacks corundum and spinel and the pyroxene present is augite and/or hypersthene. The Lavant body is viewed as a high level gabbro intrusive which penetrated a carbonate cover. The initial phases cooled slowly and fractured but the late phases cooled quickly filling fractures within the body. No evidence exists for the intrusive as being completely differentiated but late stage felsic fluids were present. The Lanark-Oso body is essentially a well differentiated mafic intrusive containing pyroxenite-periodite, gabbro, anorthositic gabbro to gabbroic anorthosite and anorthosite phases. Corundum and spinel are common in certain zones, and anorthositic phases are among the most common outcroppings. Pyroxene is chiefly composed of diopside and enstatite. No roof pendants of crustal material are present and fine grained phases are rare. The presence of spinel suggests that their is residual Cr in the chemistry of this intrusive. In all it appears that the Lanark-Oso mafic intrusive is a deeper level intrusive than the Lavant intrusive. The Lanark-Oso body shows little recrystallization within the anorthositic phases. The only exception is along the southern contact where plagioclase metacrysts have formed and are pervasively altered to sericite. Despite the fresh appearance of the body in general it would seem that body was intruded at least before the wanning period of metamorphism. It is doubtful that the intrusion is pre-metamorphism as only the contacts are metamorphosed. It is possible that the body is post-metamorphism and moved into the crust as a relatively cool passive mass with metamorphism near the contacts being generated by the intrusive event itself. The author favours the latter situation as it explains the lack of metamorphism within the interior of the anorthosite mass, yet high grade metamorphic rocks surrounding the body. It should be mentioned that the Lanark-Oso body would be classified as a labradorite-type massif under the classification of Anderson and Morin (1968).

GEOCHEMISTRY OF THE LANARK/OSO ANORTHOSITE MASSIF

Eight samples of the anorthosite phases of unit 8 located in the Lanark-Oso Anorthosite Massif were analysed for their major element, CO_2, S, and loss on ignition concentrations. The results of this analysis is provided on Table 9. Immediate chemical characteristics of this suite of anorthosites indicate the high concentration of alumina typically 30-33 percent and the high concentration of lime with respect to soda (2 to 6.7 times). These values reflect the high percentage of plagioclase in these rocks and the lack of anorthite but abundance of plagioclase of labradorite composition. Comparison of the abundance of silica, potash and magnesia with respect to other Grenville anorthosites is given in Figure 1. With respect to these three elemental concentrations the Lanark-Oso body is most like the Morin in SiO_2, similar to the Morin, Lac St. Jean, and the Marcy bodies in K_2O, yet similar to the Lac St. Jean, Nain and Marcy bodies in MgO. In fact none of these anorthosites bodies have consistent common characteristics with respect to chemical fingerprinting.

Like most Grenville anorthosite bodies the Lanark-Oso body lacks a sufficient volume of exposed gabbro and gabbroic-anorthosite to warrant its evolution from a basaltic melt via differentiation alone. However, the body is essentially surrounded by large volumes of silicic gneisses which mineralogically would be granodioritic to tonalitic in composition. In this respect the Lanark-Oso body is similar to Lac St. Jean body studied by Kehlenbeck (1974), and Frith and

Currie (1976). Table 10 depicts the comparison of the elemental concentrations of original tonalite, residual compositions of tonalite after 25 percent and 75 percent anatectic melt, average Lanark-Oso anorthosite composition, average Adirondack anorthosite composition (Budington, 1939) and average Lac St. Jean anorthosite composition (Kehlenbeck, 1974). This comparison clearly shows the major element differences in the Lanark-Oso anorthosite body and that of the average Adirondack and Lac St. Jean are the relative SiO_2 depletion, Al_2O_3 enrichment, CaO enrichment, and Na_2O depletion. As anatexis progresses the table shows that silica continues to be depleted while alumina and lime are enriched as soda remains virtually unchanged. It is clear from the data presented that assuming an original tonalite composition the same as that of Frith and Currie the Lanark-Oso body composition would be attainable only at levels much greater than 75 percent anatectic melt. However, with an original tonalite composition of approximately 63 percent silica, 21 percent alumina, 7.6 percent lima and 3.0 percent soda the Lanark-Oso composition would be possible with close to 75 percent anatectic melt. In sum, the Lanark-Oso body anorthosite composition could be achieved with no less than 75 percent anatectic melt.

An anatectic melt residual petrogenesis for the Lanark Oso anorthosite body is favourable from several standpoints as it explains the lack of a volume of gabbroic rocks able to generate such a volume of anorthosite by differentiation alone, also the body is surrounded by anatectic gneisses and migmatites which not only indicates that anatexis was occurring but many of the gneisses are granodiorite in composition as well representing possible starting rock compositions. The beginning tonalite composition suggested for the Lanark-Oso body requires higher CaO concentrations which is quite feasible with the presene of high-grade marbles throughout the high-grade sequence. Being a residual phase after 75 percent anatectic melt would explain the apparent late-stage metamorphic nature of the body as the passive residuum was implaced and only secondary alteration (sericitation) occurred along the contacts (discussed in previous section above). The presence of coroundum in the body represents discrete sites where the silica content was lower and the alumina content higher than that needed to form feldspar. Another feature of the anatectic melt-residua petrogenesis is that it explains the great differences seen geochemically between various anorthosite bodies in the Grenville Province. Clearly, the variation in geochemistries of the original starting materials accounts for the resultant variations in the resulting anorthosite residuals.

LATE GRANITIC INTRUSIVE ROCKS

Map unit 9 represents late stage felsic rocks and related pegmatitic rocks which are granitic in composition and intrude essentially all the above rock units. This unit outcrops in three different habits within the map-area. The most prevalent is a continuous band which essentially flanks the southern border of the metasedimentary belt comprising the metasediments of units 3, 4, and 5. This band runs from the southwestern shore of Sharbot

Lake in a northeast direction through Silver Lake and Maberly passing just south of Fagan lake on the northeastern boundary of the map-area. This band has a maximum width of approximately 1.5 km and usually separates the high grade gneisses of map unit 1 from the metasediments of units 3, 4 and 5. The second mode of occurrence of this unit is as large (3 km maximum) irregular shaped bodies in the southwest portion of the map area in the vicinity of Black Lake, White Lake, Warren's Lake and Twin Lakes, again intrusive into the metasediments of units 3, 4, and 5. The last mode of occurrence of this unit is as pink and white pegmatite dykes and sills intrusive into any of the rock types described previously but most spectacular as resistant sub-parallel dykes and irregular masses in the carbonate metasediments of map unit 4. This unit is very similar in intrusive character, structural setting and composition to the MacLean Granitic Intrusive in the Long Lake Area (Wolff, 1979), and is considered a contemporaneous northeasterly extension of this intrusive.

Map unit 9a represents fine to medium grained massive to foliated biotite granite and quartz monzonite with biotite greater than 15 percent. These two rock types are grouped together because of the intimate association of the two and the relatively small proportion of the first. This unit weathers a pink-brown-rust colour in the field and grain sizes typically vary from 0.5 mm to 2.0 mm. The modal abundance of this unit is given in Table 11. Plagioclase is mainly oligoclase in composition and both microcline and orthoclase compose the K-feldspar component. Epidote, sphene and opaques (pyrite) are the minor mineral phases. The texture is hypidiomorphic granular.

Map unit 9b represents medium to coarse-grained, equigranular massive biotite granite and quartz monzonite with biotite less than 10 percent of the rock. This rock weathers a pink colour with only a small amount of dark streaks. Grain size is typically 0.1 mm to 2.0 mm and the modal abundances are given in Table 11. The only difference between this unit and unit 9a is the biotite content, textures are similarly hypidiomorphic granular.

Map unit 9c define a fine to medium grained massive to foliated biotite granodiorite. This unit weathers a pinkish to whitish grey. Grain size ranges from 0.2 mm to 2.5 mm and the modal abundance indicates plagioclase (oligoclase) 47 percent, with equal amounts of orthoclase and quartz (12 percent). Biotite is 15 percent of the rock and hornblende apatite and pyrite re minor mineral constituents. The texture of this unit is typically hypidiomorphic granular.

Map unit 9d represents fine-grained leucocratic granodiorite. This unit is localy well developed and excellent exposures can be investigated along Highway 7b across and immediately west of the entrance to Sharbot Lake Provincial Park. This unit weathers a distinctive chalk white and is often pyritiferous hence stained by limonite weathering. Modal abundances of this unit are included in Table 11 and indicate the major phase to be plagioclase (albite to oligoclase) 50-60 percent, K-feldspar (microcline/orthoclase)

10 to 35 percent, and quartz 10-20 percent. Minor phases are biotite, muscovite and pyrite each of which are less than 5 percent. Where orthoclase occurs it is perthitic and the texture of this unit is hypidiomorphic granular.

Map unit 9e is medium grained massive to foliated syenite hornblende biotite epidote. This unit differs from that of map unit 8g in that 8g contains 50 percent or more mafic minerals while this unit contains 30 percent or less mafic minerals. Modes of a sample of this units are included in Table 11. The major phases are plagioclase (oligoclase) 16 percent, orthoclase 40 percent, and microcline 20 percent. Quartz, biotite, apatite and pyrite are minor phases each being less than 10 percent. The texture of this unit is hypidiomorphic granular and the unit weathers a pink to salmon pink colour in outcrop.

Map unit 9f represents porphyritic varieties of the above map units, but chiefly this texture is limited to map units 9a, and 9b. Phenocrysts present can be either quartz or feldspar and usually microcline is the chief feldspar phenocryst. The size of the phenocrysts vary but typically range from 2.0 mm to 6.0 mm.

Map unit 9g is used to code those rock types containing visible muscovite, usually greater than 10 percent.

Along the major shear zone which passes through the hamlet of Clarendon Station rocks of unit 9 occur and are highly sheared. Map unit 9h represents shear zone quartz monzonite and granodiorite phases including protomylonite, mylonite, and mylonite gneiss ± porphyroclasts and usually containing epidote.

Protomylonite types typically contain a bimodal grain size distribution of quartz comprised of 0.2 mm mortar texture matrix, with larger 2.5 mm resistant grains of quartz and plagioclase (andesine) and K-feldspar (orthoclase). The rock has a foliation defined by biotite grains and contains 10-50 percent matrix. Usually, the quartz is bimodal as above, but a much higher proportion of it is fine grained (as the matrix proportion increases). Micas also tend to be of a high concentration in these rocks as well (10-15 percent) as opposed to 10 percent in the protomylonite. Mylonite gneiss samples show a definite alignment of the quartz and feldspar grains and an extremely well developed foliation gneissosity. The mineralogy of these rocks is dependent upon the original rock type, hence most of the sheared phases of map unit 9 are quite felsic.

The pegmatite dykes and irregular masses/sills found throughout the area are considered to be phases of this late stage granitic intrusion. Map unit 9i represents pink granodiorite pegmatite dykes and irregular masses/sills, locally containing tourmaline ± biotite ± muscovite, and map unit 9j represents white granodiorite pegmatite dykes and irregular masses/sills, locally containing muscovite ± biotite ± almandine garnet. Despite the colour difference and the difference in accessory minerals present Table 11 clearly shows that the major mineral compositions of these two rock units is quite similar each containing 35-40 percent quartz, 25-35 percent plagioclase (albite), and 15-20 percent perthitic orthoclase. Dykes of the above material vary in width from 0.2 m to 0.8 m but local 5.0 m wide dykes can be found. Perhaps the most outstanding dykes occur in the carbonate metasediments (map unit 4) along the Zealand road between Zealand and Highway 7, and along the Zealand-Oso road west of Zealand. The high (6 m to 8 m) relief of these dykes is due to the large contrast in resistance to erosion between the granodiorite and carbonate material. Irregular masses of pegmatitic material vary in width but seldom continue for more than 500 m.

Prominent along the contact of the main band of map unit 9 and the metasedimentary rocks of units 3, 4 and 5 are scattered inclusions, xenoliths and slices of undifferentiated metasedimentary rocks of map units 3, and 5. In zones where the concentration of these are high a weak "ghost stratigraphy" can be seen, but this is usually discontinuous. Where the included material is less than 0.5 m wide a well defined but discontinuous gneissosity is locally developed. Such metasedimentary inclusions and assimilations are coded as unit 9k.

Map unit 9L represents quartz veins and dilation fillings $\pm$ magnetite. These are typically less than 25 cm in width and vary in length from 0.3 m to 0.7 m for dilation fillings to several meters for veins.

Locally, map unit 9 displays excellent horizontal jointing. Orthogonal to this is an essentially vertical jointing which creates a spectacular jointing array when seen in the third dimension. Outcrops displaying this well developed orthogonal jointing in the absence of foliation can be found along Highway 7 along the shore of Silver Lake.

LATE MAFIC INTRUSIVE ROCKS

Map unit 10 is used to code unsubdivided mafic (diabase) dykes. The most prominent of these is located at the junction of Highways 509 and 7. At this location a dyke of somewhat sheared diabase cuts carbonate metasediments of map unit 4 at a shallow angle (see Photo 6). This rock was thin sectioned and contained 18 percent quartz, 31 percent plagioclase (albite) 28 percent hornblende, 10 percent sphene, 8 percent pyrite and 5 percent biotite in the mode. The dyke is approximately 1 m in width. These late stage mafic dykes are very uncommon in the map-area.

CENOZOIC

QUATERNARY

PLEISTOCENE AND RECENT

The bulk of the Cenozoic sediments in the map-area were deposited during the Pleistocene epoch in glacial and post-glacial lakes. The bulk of these deposits are outwash deposits of sand, silt, clay and till. Perhaps the most striking Pleistocene deposit in the map area is a narrow band of glacial, glaciofluvial and glaciolacustrine deposits which occupy the major shear zone which passes through the hamlet of Clarendon Station. Henderson (1973) described these deposits as "ice-contact stratified drift; sand, gravel, minor till in eskers, kames, kame moraines; topography generally hummocky, but may be locally subdued by wave action". This glaciofluvial system was traced by Henderson (1973) northeastward through Snow Road Station, Palmerston Township, Frontenac County, and is described to the southwest through the village of Mountain Grove by Wolff (1979), and Henderson (1973), giving it a total strike-length of some 80 km in the Precambrian Shield. Using the nature of this Pleistocene deposit as it occurs in the present map area and the Long Lake area, it appears that the major shear zone may itself extend for such a distance as the glaciofluvial deposits have employed the shear zone as a natural low relief pathway. Other glaciofluvial Pleistocene deposits in the map area ocur on the edges of the Bolton Creek Valley which traverses the entire map area west to east in the north-half of the map area. Two notable concentrations occur between Highway 509 and the Pennick Lake Road immediately southof Bolton Creek, and spotted occurrences flanking Bolton Creek to the east and west of the road running north from the hamlet of Zealand. Pleistocene deposits in the remainder of the map area include ground moraines and sandy till, (Henderson, 1973). Glacial striae do not abound in the map area but general trends given by Henderson (1973) indicate southwesterly oriented trends.

Recent deposits in the map area are comprised of organic swamp and alluvial deposits, or as described by Henderson (1973) include bog deposits, muck and peat; areas of fen vegetation, marsh and meadow. The main areas of these type of deposits include the Bolton Creek Valley; the eastern portion of the major shear zone pasing through the hamlet of Clarendon Station north of Pennick Lake; an east-west oriented zone passing through the hamlet of Oso; a grossly circular area surrounding Chambers Lake immediately north of Highway 7 near the junction with Highway 38; a prominent trough trending northeastward from Graceys Island in Sharbot Lake and extending for some 5.2 km; much of the area immediately flanking the Fall River including the entire east end of Silver Lake; and irregular areas within the Lanark-Oso anorthosite massif and surrounding high grade gneisses (unit 1).

METAMORPHISM

The rock in the map area have undergone regional metamorphism during the Late Precambrian. Mineral assemblages vary with the large number of rock chemistries present and the grade of metamorphism and subsequent lateration.

In general, the map area can be divided into two metamorphic zones; A) The metasediments of map-units 3, 4, 5 and the metavolcanics of map unit 2 situated north of the contact of map unit 1 and 9 and the healed major shear zone which parallels this contact; B) The rocks of map unit 1 and 4 which lie south of this contact.

The best rocks for metamorphic mineral indicators in the map area are the metasediments and metavolcanic rocks plus the granoblastites (high grade gneisses). Unfortunately, the clastic siliceous metasediments are aluminum-poor hence the alumino-silicate indicator assemblages cannot b utilized. The late felsic intrusives (map unit 9), the syntectonic felsic intrusives (map units 6 and 7) and the mafic intrusives (map units 8 and 10) are only weakly metamorphosed usually to the extent that plagioclase is sericitized to varying degrees.

ZONE A

Metamorphic zone A contains the following metamorphic mineral assemblages:

Clastic Siliceous Gneisses (Map unit 3);

quartz + plagioclase + biotite ± muscovite 1)

quartz + plagioclase + biotite + almandine ± muscovite 2)

Carbonate Metasediments (Map unit 4):

calcite + dolomite + diopside + tremolite + quartz 3)

Amphibole Rich Gneisses and Schists:

plagioclase + hornblende + biotite ± quartz (4)
(oligoclase-
andesine)

plagioclase + hornblende + calcite ± apatite 5)
(oligoclase-
andesine)

plagioclase + hornblende + calcite ± biotite ± diopside 6)
(oligoclase-
andesine)

The above mineral assemblages indicate that rocks of this metamorphic zone lie in the low temperature (500°C-550°C) field of medium grade metamorphism (Fig. 2), as given by Winkler (1976). Assemblage 1 places this zone above the "muscovite-chlorite out" isoreaction-grad, but below the "muscovite +quartz -- K-spar + sillimanite" isoreaction-grad. Assemblage 2 places these rocks above the "almandine in" isoreaction-grad. Assemblage 3 is important as it puts a constraint on the pressure of 2-4 Kbar.

Assemblages 4, 5, and 6 are important as the plagioclase composition positions these rocks above the "An17 + hornblende" isoreaction grad.

ZONE B

Metamorphic zone B contains mineral assemblages and textures which are diagonistic of the regional hypersthene zone or high grade granolite zone as described by Winkler (1976). It should be noted that rock units occurring in this zone are mainly mafic to silicic migmatites and anatectites of map unit 1. Local zones of high grade carbonate metasediments of map uit 4 are also present in this metamorphic zone. Also present in this metamorphic zone are gabbroic and anorthositic phases of map unit 8 which in themselves do not show explicit signs of metamorphism. The typical metamorphic mineral assemblages present in this metamorphic zone are:

Mafic Migmatites and Anatectites:

diopside + biotite + hornblende + plagioclase ± quartz 7)
(oligoclase-
labradorite)

Silicic Migmatites and Anatectites:

diopside + biotie + plagioclase ± hornblende ± quartz 8)
(oligoclase)

Carbonate Metasediments:

calcite + dolomite + tremolite + diopside + quartz 9)

It should be noted that the lack of hypersthene in any rock type, combined with the lack of the mineral assemblage almandine garnet and diopside plus quartz defines these rocks to be classified as granoblastites rather than granolites (Winkler, 1976). The lack of hypersthene in this zone, particularly in the mafic rocks deserves some attention. DeWaard (1965) has shown that the assemblage orthopyroxene + plagioclase becomes unstable if load pressures exceed a critical value at constant temperature. The reaction:

[hypersthene + plagioclase] = [clinopyroxene + garnet + quartz]

eventually stabiles the mineral assemblage:

Clinopyroxene + garnet + quartz + either plagioclase or hypersthene

Thus, the mineral assemblage 7) present in metamorphic zone B is indicative of the higher pressure clinopyroxene-almandine-quartz granolite subzone of the regional hypersthene zone. The presence of hornblende and biotite indicate that the mafic rocks of metamorphic zone B are in a transitional state and specifically lie on the cpx-plag tie line (Fig. 3). In comparison to the Long Lake Area (Wolff, 1979) which contains mafic rocks of the regional hypersthene zone that are diagnostic of true granolite-containing hypersthene. This indicates that although temperatures between the high grade metamorphic rocks of the Sharbot Lake Area and the Long Lake Area were probably similar pressures were higher in the Sharbot Lake area suggesting the Sharbot Lake high grade gneisses represent an even lower level assemblage than those of the Long Lake Area.

The silicic migmatites and anatectites or pelitic granoblastite mineral assemblages in this metamorphic zone indicate the presence of cpx hornblende biotite (assemblage 8). These rocks are similar to granoblastites described by Reinhardt and Skippen (1970) in the Westpot Area (south and east of the present map area). The lack of sillimanite and kyanite in rocks of the Sharbot Lake Area does not suggest lower pressures in this area but compositional differences especially in the lack of excess Al_2O_3 in the rock chemistry.

The carbonate metasediments in this metamorphic zone do not show significant differences from those of zone A (compare assemblages 3 and 9). This is typical as $P_{H_2O} << P_{Total}$ in granolite metamorphism (Winkler, 1976).

A range of pressure and temperature conditions for metamorphic zone B would have a lower limit from 5 Kbar and 650°C to accommodate metamorphic assemblage 9 and an upper limit of 8 Kbar and 700°C (the minimum stability of cpx + garnet + quartz (Green and Ringwood, 1967), see Fig. 2.

STRUCTURAL GEOLOGY

REGIONAL SETTING

The map-area lies within the Central Metasedimentary Belt of the Grenville Structural Province as defined by Wynne-Edwards (1972), and specifically lies mainly within the IVc segment, with the very northwest corner being part of the IVb segment. The contrast in structural geology between the two zones is poorly illustrated in the map area because of the small exposure of the IVb segment and the lack of supracrustal rocks at the expense of a dominance of intrusive rocks in that part of the field area. The two zones are separated by the major shear zone which passes through the hamlet of Clarendon Station, which strikes to the south-west through the Long Lake Area. For a thorough description of the contrast in structural geology between the IVb and IVc segments the reader is directed to the Geology of the Long Lake Area (Wolff, 1979). Thus, regionally, the map area is mainly in the Frontenac Axis or IVc segment of the Central Metasedimentary Belt and contains the paragneissic, plutonic and gneissic terranes indicative of this segment as described by Wynne-Edwards (1972).

FOLIATION, FOLDING, BOUDINAGE AND GNEISSOSITY

Under these criteria the map area can be considered to be essentially a structural entity. The foliation is best developed in the supracrustal (map units 2, 3, 4 and 5) assemblages and strikes northeast (040^{o}-060^{o}) with moderate dips (025^{o}-055^{o}). (It should be mentioned that locally a foliation-gneissosity is developed which indicates both foliation and gneissosity are present but the rock cannot be considered to have reached the metamorphic state of a bona fide gneiss). The foliation is considered to be a S_1 foliation which is essentially parallel to the S_o bedding. The strike mentioned above is very continuous and the only perturbation to the orientation occurs in the vicinity of Sharbot Lake. In this area (starting from the southwest corner of the map area) the supracrustals strike east-northeast (060^{o}-080^{o}), swing more north-northeast (030^{o}-045^{o}) then swing back to a northeast (040°-060°) orientation for the remainder of the map area. This elongated "S" perturbation represents the deformtion of the supracrustals around the southern portion of a late stage granitic intrusion situated east of White Lake and north of Black Lake. This more structurally competent body created a resistant "island" about which the less competent supracrustals were deformed.

These units are foliated into sinclinal folds (F_2) which plunge shallowly (25°-35°) northeast (040°) and are essentially axial planar to the F_2 fold axis. These minor folds are poorly developed and difficult to trace because of the steep dip of the units themselves. Evidence for slippage during deformation is omnipresCenced by quartz and hornblende rodding giving L_3 lineations (130°/35°) which are essentially a dip-slip component. Such rodding features are best developed in units exposed in the stretched "S" structure around Sharbot Lake. Another structural feature often found in these supracrustals is boudinage. This mainly occurs in the more quartz-feldspar rich metasediments with pinch and swelling of quartzo-feldspathic layers. The boudinage is localy coupled with brittle fracture which creates segmented bouding in three dimensions. Fig. 4 depicts the sequence of events. Stage I indicates a quartzo-feldspathic layer surrounded by more micaceous layers. With boudinage and rodding the development of "pinch and swell" type structures elongated in the c dimension (Stage II). Brittle fracture first paralleling the b-c plane creates segmented boudins, which because of their short a-b dimensions with respect to the longer c dimension are weak in the c dimension and are further segmented parallel to the a-b plane creating rodded clasts as depicted in stage III. The potential confusion of this resultant product and pebbles associated with conglomerates is evident. Fortunately, in the map-area whenever Stage III boudin-clast were located Stage II and eventually Stage I situations were traceable along strike - definite proof that these features are the result of plastic followed by brittle deformation (see Photos 7, 8, 9 and 10).

The existence of foliation and foliation-gneissosity (S_1) parallel to the original bedding or compositional layering, the absence of axial planar foliation, the absence or existence of few minor folds and lineations (L_2) parallel to major fold axes suggest that structurally the map-area has been subjected to flow folding as described by Wynne-Edwards (1963).

It should be noted that the supracrustals described above are not part of the Clare River Synform (Schwertdner, 1977; Wolff, 1978, 1979). Although the supracrustals within the Clare River Synform and those described above have similar mineralogies and modes of occurrence the Clare River Synform structure is not continuous into the map area, but truncated by a major shear zone (see below). Thus the Clare River Synform structure has an eastern limit situated between Mountain Grove and Clarendon Station (most probably west of White Lake, and does not extend for 95 km from its closure near Madoc to Carleton Place as a structural entity as suggested by Reinhardt (1964).

The mafic to silicic migmatites and anatectic gneisses of map unit 1 possess well developed gneissosities. These parallel the foliation orientations mentioned above striking (040°-060°) with moderate dips (025°-055°). Structurally, these gneisses are quite monotonous, containing no boudinage, rodding or minor folds, in outcrop.

FAULTING, FRACTURING, DYKING AND LINEAMENTS

Perhaps the most strikingly developed of these features in the map area is that of faulting. Two faults of a regional scale transect the map area. The first and most prominent from a physical point of view is the major shear zone, located in the northwest corner of the map-area, that passes through the hamlet of Clarendon Station. Although this feature has a strike length of 6 km in the map-area it extends to the southwest and northeast for a total length of some 80 km. A description of the physiography and geology of this zone is given in some detail in the Long Lake Area (Wolff, 1979). In the present map area the shear zone is approximately 0.5 km to 1.0 km in width. Lithologies wthin the shear zone are dominantly protomylonite and mylonite. Mylonite gneiss is indeed rare but may be present in the more intensely deformed portions of the shear zone much of which is covered by Pleistocene and to some extent Recent sediments. The movement on the shear appears to be primarily dip-slip with the relative movement being west side up east side down where slickensides were discernable, (this in fact, however, may represent a local block within the shear as the geology suggests the eastern side represents lower level lithologies both in the present area and the Long Lake Area). Regardless, the shear seems to be a normal dip-slip fault. The shear zone itself strikes north steeply ($005^{o}/65^{o}$).

The second major fault is not nearly as obvious in physiographic expression, but well developed geologically. This fault represents a major shear zone which have been partially annealed by late stage felsic intrusives. This shear zone occurs at the contact of unit 9 and map unit 1 and extends from Sharbot Lake to the eastern boundary of the map area, possessing a total strike length of approximately 17.8 km in the map area. There is no evidence that this feature does not extend south into the Tichbourne Area. The geological evidence for this shear zone is the excellent development of augen bearing gneisses immediately adjacent to this contact and for up to 1.5 km accross strike from the contact. A typical augen-bearing texture is given in Photo 1. This shear zone has no equivalent deformation structures on the north side of the contact. The unit 9 granitic intrusives have used this fault zone as a pathway and effectively healed the original fault. The lack of augens and similar cataclastic structures in supracrustals north of the contact can be attributed to the relative competency contrast between the gneisses of unit 1 and the metasediments, and/or the replacement of massive granitic material (itself typically 1 km in cross-strike dimension) totally obscuring any highly deformed lithologies that may have existed in the metasediments at/or within approximately 1 km of the fault zone face. The movement on the shear zone is likely east (south) side up and west (north) side down as the unit 1 gneisses to south and east represent lower level assemblages.

Jointing is best expressed in the intrusive rocks and is generally trending southeast-northwest, or north-south with vertical dips. A third, essentially horizontal joint set is locally developed in the rocks of unit 9 south of Silver Lake. Any given minor faulting (outcrop scale) appears to parallel the southeast trending joint set. Late stage quartz veins are found to parallel both vertical joint sets. The most abundant dykes are the pegmatite dykes of map units 9i and j. These generally possess a north, northeast orientation (020°-045°) and are not typically related to any of the above joint sets. It should be noted that in comparison to the Long Lake Area (Wolff, 1979) and Kaladar Area (Wolff, 1978) the vertical joint sets of the present map area correspond to the second and third joint sets of the Long Lake Area, with the northeast-southwest set being absent in the present area (pegmatite filled). Likewise, in comparison to the Kaladar Area the north-south joint set is present and the southeast-northwest set is present but the east-northeast set is absent in the present map area.

Numerous lineaments can be traced on air photographs and on the surface in the map area, a number of which can be ascribed to faulting and fracturing. Due to insufficient straigraphic and structural control none of these can be assigned movements. The more prominent lineaments along which fault movements may or may not have occurred are indicated on Geological Map (+++) (back pocket).

AEROMAGNETIC DATA

Comparison of Geological Map (+++) (back pocket) and the available aeromagnetic survey (G.S.C. 1952) indicates a reasonable correlation between aeromagnetic patterns and rock type. The aeromagnetic patterns can be divided into three gross types: 1) wide contour spacing and low flux (300-1200 gammas); 2) dense contour spacing and high flux (1000-3000 gammas) and 3) moderate spacing and moderate flux (900-2500 gammas).

The first pattern is typical of the large outcroppings of carbonate metasediments (map unit 4) and the Lavant Gabbro body (map unit 8) in the north half of the map sheet. These two rock types are essentially indistinguishable from one another in the magnetic values because of the relatively low and overlapping concentration of magnetitic minerals in these two particular rock types. This aeromagnetic pattern is also typical of the carbonate metasediments outcropping in the vicinity of Bolingbroke in the southeast corner of the map area.

The second type of aeromagnetic pattern is found in three major areas of the map sheet, a continuous zone adjacent to the Fall River, a zone immediately west of Rock Lake and an area immediately north of Maberly. Four zones including one immediately north of Maberly, and three immediately south can be associated directly with the outcropping of gabbro and anorthositic gabbro (map unit 8). The isolated domal nature of the aeromagnetic patterns created by these bodies suggests that the other similar shaped anomalies that is two zones between the abandoned CPR track and Clear Lake, and the zone west of Rock Lake actually represent gabbroic concentrations masked by the overlying gneisses (map unit 1) and anorthositic-gabbro (map unit 8). Thus the aeromagnetic data indicates the presence of gabbro bodies not exposed.

The third pattern represents the bulk of the rock types in the map-area including map units 1, 2, 3, 5, 6, 7, the anorthositic phases of map unit 8, and map unit 9. Map unit 10 possesses no aeromagnetic expression. None of these rock types are distinguishable aeromagnetically from one another at the scale of the aeromagnetic maps available (1:63,360).

In general the aeromagnetic data does not reflect any of the faulting in the map-area.

ECONOMIC GEOLOGY

The Sharbot Lake area contains a variety of metallic and non-metallic mineral deposits. In 1979 the only mineral production was local sand and gravel extraction for road bed construction and maintainance.

Metallic mineralization consists mainly of gold, copper, nickel, iron and uranium. The known gold occurrences are limited to pyritiferous late stage quartz veins which cut clastic siliceous metasediments (unit 3) and are associated with copper, nickel and iron concentrations. Uranium concentrations are associated with the Addington Pluton (unit 7) but only reach background levels within the map area. The anomalously high concentrations are situated just to the north of the map-area in this unit and are similar to the uraniferous concentrations encountered in the Kaladar Area (Wolff, 1978). Unless otherwise stated all assay values and details of exploration are from files in the Assessment Files Research Office, Ministry of Natural Resources.

Non-metallic mineral concentrations are more abundant and include apatite, mica, feldspar, corundum, garnet, talc and marble. Apatite has a number of modes of occurrence including disseminations within carbonate metasediments (unit 4) and more massive concentrations in the skarn phases of this unit. The second mode of occurrence is that of massive dykes of apatite within phases of migmatites and anatectic gneisses (unit 1) reported by Harding (1947). This unit is also host to local concentrations of mica in the map-area. Concentrations of feldspar are abundant in map-unit 8. The anorthosite phases of this unit contain large, well exposed volumes of feldspar, with minor amounts of corundum in apparently well defined zones. Concentrations of garnet are mainly limited to phases of map unit 1 in the southeast corner of the map-area, near the hamelt of Bolingbroke. Minor concentrations of talc can be found in skarn phases of the carbonate metasediments but a very promising occurrence for economic extraction is found within the metavolcanic units (2) immediately adjacent to the major zone just west of Pennick Lake. Concentrations of marble abound within the map-area. Since the mapping technique employed differentiated between calcite-rich phases, and dolomite-rich phases zones of either can be delineated on the map by tracing unit 4a and 4b respectively.

PROSPECTING AND MINING ACTIVITY

Recorded data on mineralization in the area dates back to the late 1800's in the works of Murray (1852), Vennor (1868) and White (1893) each of whom were mapping for the Geological Survey of Canada. Results of such investigations saw the mining of vein-type apatite for phosphate circa 1900. The period circa 1910 saw the concentrated search for mica and feldspar in the map-area. Although no significant deposits of feldspar were revealed one mica occurrence was worked for a short period of time. A third thrust in exploration circa 1940 saw the prospecting for gold in southwestern Ontario. A number of minor test pits were sunk in the map-area, none of which became economically feasible. The period 1957-59 saw a renewed interest in base metal and gold exploration in the area as well as an interest in uranium-bearing lithologies, resulting in some diamond drilling in the map-area, but no economical finds. A renewed interest in uranium was sparked in 1969 resulting in some airborne geophysical work in the northwest corner of the map-area. The latest period of exploration activity in the map-area centered on the uraniferous zones bordering the map-area to the north and was performed by the joint Federal-Provincial Uranium Reconnaissance project (GSC, 1976, 1979), but yielded only background values within the map-area proper.

METALLIC MINERALIZATION

GOLD

Gold mineralization found within the map-area is in late stage quartz veins and/or granite dykes and cutting metasediments of unit 3. Gold in these occurrences is present in trace concentrations and is associated with other base metal sulphides of Cu, Ni and Fe. It would appear that the gold has in some way been concentrated in these late-stage fillings from the surrounding metasediments as quartz veins in other lithologies are barren.

DESCRIPTION OF DEPOSITS

LOT 23, CONCESSION I, OSO TOWNSHIP

BOURK, R.T. OCCURRENCE (I)

Harding (1947), assayed chip samples of chalcopyrite and pyrite and malachite for gold values from a small pit (2 m deep), sunk by William Duffy on the farm of R.T. Bourk in the early part of the century. The chip samples are reported to have contained low gold values. The mineralized zones were within quartz rich phases of a granite dyke cutting metasediments and metavolcanic units.

WEST-HALF, LOT 18, CONCESSION IV, OSO TOWNSHIP

MCVEIGH R. OCCURRENCE (5)

In 1937 a pit 4 m deep was sunk in a narrow dykes of fine-grained late-stage granite (unit 9) cutting carbonate metasediments (unit 4), by R. McVeigh. The dyke is less than 1 m wide and contains disseminated pyrite. Harding (1947) reports that McVeigh reported low gold values from this occurrence.

LOT 15, CONCESSION II, OSO TOWNSHIP

MARROW A. OCCURRENCE (6)

This showing is situated between Highway 38 and the abandoned branch of the Canadian Pacific Railway running north from Sharbot Lake to Clarendon Station. The occurrence is composed of disseminated pyrite in a late-stage quartz vein cutting quartzites of unit 3. A pit 1 m deep and 5 m in length was worked by Marrow between 1941 and 1944. Harding (1947) reports that low gold values (0.01 ounce) were reported from this pit.

WEST-HALF, LOT 14, CONCESSION I, OSO TOWNSHIP

CREMAC SURVEYS CO. LTD. (2)

In 1959 Cremac Surveys Co. Ltd. sunk a number of diamond drill test holes in metavolcanic and metasediment units in the Mountain Grove-Sharbot Lake area (Wolff, 1979). A 93 m hole in metasediments of unit 3 intersected sporadic disseminations of pyrite, pyrrhotite and chalcopyrite which were most concentrated adjacent to granite pegmatite veins (unit 9) cross cutting the metasediments, and 0.6 m of mineralized section indicated trace amounts of gold when assayed.

NORTH-WEST 1/4, LOT 12, CONCESSION X, OLDEN TOWNSHIP

CREMAC SURVEYS CO. LTD. (2)

In 1959 Cremac Surveys Co. Ltd. sunk a 72.0 m diamond drill hole into metasediments of unit 3. Quartz veins and stringers in the metasediments contained minerlized zones of pyrite and pyrrhotite. A 0.6 m section of this core yielded trace amounts of gold.

BASE METALS Ni, Cu, Fe

The base metals Ni, Cu, and Fe have been grouped for description because of their close association in the map-area and the small amount of occurrence of any one given element.

Ni, Cu, and Fe are manifested in the field area by the minerals pyrrhotite, chalcopyrite, malachite, and pyrite. Concentrations are essentially limited to the metasediments of unit 3 and assayed values of these metals are chiefly associated with searches for gold. Pyrite is a common mineral within the metavolcanics (unit 2), the clastic siliceous metasediments (unit 3), the carbonte metasediments (unit 4) the amphibole-rich gneisses and schists (unit 5) and the late-stage felsic intrusive (unit 9).

Magnetite and hematite mineralogy is not uncommon in the late-stage quartz veining (unit 9).

DESCRIPTION OF DEPOSITS

EAST-HALF, LOT 14, CONCESSION I, OSO TOWNSHIP

CREMAC SURVEYS CO. LTD. (2)

In 1959 Cremac Surveys Co. Ltd. sunk a 122 m diamond drill hole on this property that intersected four zones of quartz veining containing abundant sulphide minerals within unit 3 metasediments. The first zone, 1.4 m in thickness assayed 0.03 percent Ni, and 0.03 percent Cu; zone two, 0.6 m thick, assayed 0.09 percent Ni, and 0.05 percent Cu; zone three, 1.0 m thick, assayed 0.02 percent Ni and 0.05 percent Cu; and the fourth zone, 0.6 m thick assayed 0.04 percent Ni, and 0.07 percent Cu. The sulphide mineralization included pyrite, pyrrhotite and chalcopyrite.

WEST-HALF, LOT 14, CONCESSION I, OSO TOWNSHIP

CREMAC SURVEYS CO. LTD. (2)

This occurrence is the same as that described above under gold. The three sulphide zones encountered yielded the following base metal values; zone one, 0.6 m thick, assayed 0.01 percent Ni and 0.04 percent Cu; zone two, 1.2 m thick, yielded 0.05 percent Ni and 0.05 percent Cu; and the third zone, 0.75 m thick, assayed 0.03 percent Ni and 0.06 percent Cu. Sulphide mineralogy included pyrite, pyrrhotite, and chalcopyrite.

NORTH-WEST 1/4, LOT 12, CONCESSION X, OLDEN TOWNSHIP

CREMAC SURVEYS CO. LTD. (2)

This occurrence is the same as that described above under gold. Three sulphide zones intersected contained the following base metal concentrations: Zone one, .75 m thick contained 0.02 percent Ni; zone two, 1.5 m thick, contained 0.02 percent Ni; and zone three, 1.0 m thick contained 0.03 percent Ni. Sulphide mineralization included pyrite and pyrrhotite.

URANIUM

Although the Sharbot Lake area contains no uraniferous occurrences proper, the very northwest corner of the map-area contains the Northbrook Batholith and Addington Pluton which contain uraniferous deposits north and immediately adjacent to the map-area. Consequently, this corner of the map-area (4) has been included in various surveys for radioactivity. The earliest activity ws that of Iso Uranium Mines Limited in 1957, consisting of 13 diamond drill holes totalling 272 m. Further work on this ocurrence in 1968 by Guardian Mines Limited included scintillometer and geological surveys, sampling, trenching, and diamond drilling totalling 1160 m. In 1969 the Keevil Mining Group Limited conducted airborne radiometric survey over the area. The latest airborne geological survey over the area was that of the joint Federal-Provincial Uranium Reconnaissance Project (GSC, 1976, 1979), which delineated the anomalous zones in more detail.

NON-METALLIC MINERALIZATION

TALC

Talc mineralization within the map-area has two modes of occurrence. The most common, but least volumnious, occurs in the skarn phases of the carbonate metasediments, while the least common, but most volumnious, occurs in the metavolcanics (unit 2) where they are immediately adjacent to the prominent shear zone just west of Pennick Lake.

DESCRIPTION OF DEPOSIT

WEST-HALF, LOT 25, CONCESSION II, OSO TOWNSHIP

PENNICK LAKE OCCURRENCE (7)

This occurrence was discovered by the field party during the 1979 field season. In outcrop the unit is composed of a north-striking talc-tremolite-serpentine-calcite schist enclosed by metavolcanics (unit 2) and minor amounts of carbonate metasediments (unit 4). The outcrop itself is composed of low ridge (maximum relief of 7 m) which is some 100 m wide and could be traced for 500 m along strike. The ridge is intersected by several northwest-trending fractures which allow examination across strike of the lithologies. Access is excellent by road as a wagon trail leads west from the Pennick Lake road along one of these fractures. The outcrop is heavily vegetated and in a wooded area of mature maples.

A thin section of one of the more talc-rich phases yielded 70 percent fine grained (0.05-0.10 cm) talc bundles and sheave with a diffuse groundmass of plagioclase (18 percent), tremolite (5 percent), iron oxide (5 percent) and opaques (pyrite) (2 percent).

This occurrence is of economic interest as talc is currently being at the RAM Petroleum Limited talc-tremolite plant south of Robertsville on Highway 509, just north of the map-area.

FELDSPAR

Feldspar concentrations in the map-area are found in two main units. Minor concentrations occur in the pegmatite phases of the late-stage felsic intrusives (unit 9). The most significant occurrence, however, occurs in the massive anorthosite phases of the early mafic intrusives (unit 8).

DESCRIPTION OF DEPOSIT

LOTS 6-13, CONCESSION VI, SOUTH SHERBROOKE TOWNSHIP, LANARK COUNTY

LOTS 7, 8, CONCESSIONS VI AND VII, OSO TOWNSHIP, FRONTENAC COUNTY

ROCK LAKE-DEER LAKE OCCURRENCE (8)

This occurrence is composed primarily of anorthosite and anorthositic gabbro. In outcrop large areas contain 90 percent plus of feldspar with minor amounts of pyroxene. This body is very massive especially in the interior, near the contacts with the gneisses of unit one a well defined lineation to weakly developed foliation can be found and in general the amount of mafic (essentially pyroxene) material increases. Selected thin sections of various phases indicate the plagioclase content is definitely calcic with An contents varying from 65-75. The feldspar grains are interlocking and the only intergranular material is pyroxene, biotite, and only trace opaques (ilmenite) in the more contaminated phases. The most feldspar-rich phases appear only to contain minor biotite. In outcrop excellent coarse-grained euhedral corundum can be found. Chemical analysis of eight samples of anorthosite show the purest phases to contain 30-33 percent Al_2O_3. The corundum however, is limited to discrete zones which could be easily avoided during mining. Not only is this deposit extremely well exposed but is readily accessible by road.

GARNET

Concentrations of garnet are most prevalent in the gneiss units (unit 1) west of Bolingbroke.

DESCRIPTION OF DEPOSIT

NORTH-HALF, LOTS 3, 4, 5, CONCESSION III, SOUTH SHERBROOKE TOWNSHIP, LANARK COUNTY

SOUTH-HALF, LOTS 3, 4, 5, CONCESSION IV, SOUTH SHERBROOKE

TOWNSHIP, LANARK COUNTY

LOTS 3 and 4, CONCESSION VIII, OSO TOWNSHIP, FRONTENAC COUNTY

SUCKER LAKE OCCURRENCE (9)

This occurrence of garnet concentration is within gneiss units of unit 1. These gneisses contain well differentiated beds of garnet biotite and quartz-feldspar (garnet locally 80 percent plus). Garnet units have a maximum thickness of 0.5 m but are continuous along strike over several hundred metres and beds often repeat within 5-10 m across strike.

MARBLE

Large portions of the map-area are comprised of gently rolling knolls of carbonate metasediments (unit 4). This unit has a variety of different carbonate, and calc-silicate assemblages but the majority of the outcrops are composed of either 1) calcite-rich marble; 2) dolomite-rich marble; 3) calcite-dolomite bearing marble (units 4a,c, and d, respectively). Since the mapping was carried out using this classification in a systematic manner each of these rock types can be delineted on the preliminary map quite easily, and thus potential areas for calcite and/or dolomite marble deposits segregated.

MICA

Mica concentrations of any size are mainly limited to the higher metamorphic grade gneisses (unit 1), small scattered phlogopite in the carbonate metasediments (unit 4) are of insignificant concentration.

DESCRIPTION OF DEPOSIT

LOT 8, CONCESSION II, OSO TOWNSHIP

HAWLEY WM. OCCURRENCE (3)

This occurrence is described by Harding (1947) and consists of a small prospect pit (6 m long and 2 m deep) which was worked on in 1925 by William Hawley, and later between 1930 and 1935 by C. Stoness. About one ton of marginal mica is reported to have been recovered from the 0.6 m vein containing calcite, pyroxene and phlogopite mica.

APATITE

Apatite occurrs as disseminations and small concentrations in various phases of the unit 4 carbonate metasediments in the map-area. In addition Harding (1947) reports that some apatite was extracted from pits south of Silver Lake in the migmatite and anatectic gneisses of unit 1 where these rocks are in contact with gabbros of unit 8. These pits yielded 250 tons of phosphate. The apatite was a brown colour and the pits apparently exhausted the apatite mineralization.

CORUNDUM

Corundum mineralization occurs in the anorthosite phases of the early mafic intrusives (unit 8) and are described above under feldspar mineralization. The corundum is coarse grained and euhedral and of interest mainly for mineralogical specimens.

SAND AND GRAVEL

Local pits of sand and gravel have been worked by various operators for local uses in road building and construction in the area. No single deposit is strikingly large but the chief sand

and gravel concentrations are located in the Bolton Creek Valley and near the village of Maberly.

SUGGESTIONS FOR FUTURE EXPLORATION

In view of the results of the present study and previous work in the area it would appear that the map-area may be of particular interest for non-metallic mineral resources.

METALLIC MINERAL RESOURCES

The occurrence of gold and base metals in the late stage quartz and/or granite pegmatite veins and dykes which cut the metasediments of unit 3 is of interest, but have in the past yielded very low concentrations and very small volumes.

Significant uranium mineralization has not been detected in the map-area and the main focus of exploration for this commodity should perhaps be concentrated to the immediate north of the map-area as delineated by the joint Federal-Provincial Uranium Reconnaissance Project (GSC, 1976, 1979).

NON-METALLIC MINERAL RESOURCES

The occurrence of the talc deposit west of Pennick Lake is of immediate interest for future exploration and should be examined as soon as practicable, especially in light of the existence of a talc-tremolite processing mill close by.

The anorthosite-feldspar deposit of Rock Lake-Deer Lake is an important deposit as well, because of its large size, purity, gold experience and accessibility. Not only should this deposit be considered for its feldspar content but its potential for building stone material should not be overlooked.

The marble deposits of the area also possess a future mineral potential, for calcite and/or dolomite.

The minerals garnet, corundum, mica and apatite are not considered by the author to be of economic significance at this time as their concentration in the field area and volume with respect to deposits currently being worked for these commodities are very small.

ROCKS AND MINERALS FOR THE COLLECTOR

Like much of the Grenville Province the map-area hosts a variety of rock and minerals for the intersted mineral collector. The carbonate metasediments contain well-deformed calc-silicate minerals locally including tremolite, diopside and talc. The late-stage pegmatite dykes and the pegmatoid leucosome phases of map unit 1 contain good feldspar and biotite books. Perhaps the best developed mineral samples, however, are the euhedral corundum crystals from the anorthosites of map unit 8 (see Photo 5). These crystals are of excellent form and are not difficult to locate, similarly, their anorhosite hosts are among some of the purest anorthosite material attainable in Ontario. Massive beds of garnet are also found in the map-area (map unit 1d) near Sucker Lake, and although seldom euhedral are striking in their high garnet content. Collectors interested in cataclastic petrofabrics will find the augen-bearing phases of map unit 1 hosting a profusion of excellent augens (see Photo 1) and protomylonite and mylonite textures can be collected from the major shear zone which passes through the hamlet of Clarendon Station.

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TABLE 1
Table of Lithologic Units Sharbot Lake Area

PHANEROZOIC
CENOZOIC
QUATERNARY
RECENT
Organic swamp and alluvial deposits
PLEISTOCENE
Outwash deposits, sand silt clay and till

Unconformity

PRECAMBRIAN
LATE PRECAMBRIAN
LATE TECTONIC METAMORPHOSED INTRUSIVE ROCKS
LATE MAFIC INTRUSIVE ROCKS
Mafic (diabase) dikes

Intrusive Contact

LATE GRANITIC INTRUSIVE ROCKS[a]
Biotite granite and quartz monzonite; biotite granodiorite; leucocratic granodiorite; hornblende, biotite, epidote syenite; porphyritic and muscovite-bearing varieties; shear zone protomylonite, mylonite and mylonite gneiss varieties; pink and white granodiorite pegmatite dykes and irregular masses; unsubdivided metasedimentary and metavolcanic inclusions; and quartz veins and dilation fillings.

Intrusive Contact

EARLY MAFIC INTRUSIVE ROCKS
Lavant and Lanark-Oso Mafic Intrusions
Gabbro, anorthositic gabbro to gabbroic anorthosite; anorthosite; quartz gabbro; monzonite; syenite; porphyroblastic and glomeroporphyroblastic varieties; granodiorite and biotite trondhjemite phases; aplitic phases; and pyroxenite and peridotite.

Fault and/or Intrusive Contact

SYNTECTONIC METAMORPHOSED FELSIC TO INTERMEDIATE INTRUSIVE ROCKS
Addington Pluton[b]

Leucocratic quartz monzonite; shear zone protomylonite, mylonite and mylonite gneiss varieties; biotite quartz monzonite; granite; and biotite granodiorite

Northbrook Batholith[b]
Biotite trondhjemite

Fault and/or Intrusive Contact

METASEDIMENTS AND METAVOLCANICS

Amphibole-Rich Gneisses and Schists[cde]
Hornblende plagioclase gneiss; amphibolite; calcite porphyroblasts and/or layers; biotite chlorite schist; biotite hornblende schist; quartz-plagioclase-hornblende gneiss; plagioclase-hornblende gneiss; K-feldspar-hornblende gneiss almandine garnet porphyroblasts; biotite-hornblende, quartzo-feldspathic schist; shear zone protomylonite, mylonite and mylonite gneiss varieties

Carbonate Metasediments[cde]
Calcite marble; dolomite marble; dolomite-calcite marble; laminated calcite marble; calc-silicate assemblages (tremolite diopside talc); fragmental dolomite-calcite marble containing flags of quartzite, quartz-feldspar and calc-silicate; quartzite and quartzo-feldspathic blocks, broken beds and flags; chert beds; mafic hornblende-rich segmented layers; coarse-grained varieties; contact skarn phases (tremolite, diopside, apatite, talc); calcite-graphite schist

Clastic Siliceous Gneisses and Schists[cde]
Biotite-quartzo-feldspathic paragneiss; biotite-hornblende plagioclase-quartz paragneiss; epidote-biotite-K-feldspar-plagioclase-quartz paragneiss; pyritic-rusty quartzo-feldspathic paragneiss; muscovite-bearing varieites; muscovite-quartzo-feldspathic schist ± garnet; biotite calcite, quartzo-feldspathic paragneiss locally schistose; garnetiferous porphyroblastic varieties; shear zone protomylonite, mylonite and mylonite gneiss; leucocratic biotite-magnetite-muscovite-quartzo-feldspathic gneiss; and banded quartzite ± biotite ± muscovite ± feldspar layers.

Mafic to Intermediate Metavolcanics[cde]

Quartz-epidote-plagioclase-hornblende ± chlorite amphibolite and amphibolite gneiss; hornblende porphyroblastic varieties; biotite-hornblende-quartzo-feldspathic ash tuff; talc, tremolite, calcite schist; and shear zone protomylonite varieties.

MAFIC TO SILIC MIGMATITES AND ANATECTIC GNEISSES[f]

Granodiorite metatexite; hornblende, labradorite, pyroxene, diatexite; quartz-feldspar rich gneiss ± biotite ± pyrite, quartz, plagioclase, biotite ± pyroxene ± garnet gneiss, well diferentiated migmatite with distinct leucosome and melanosome; quartz, plagioclase, biotite ± hornblende ± pyroxene syenitic to granodioritic diatexite; gabbroic gneiss; and pegmatoid leucosome

Notes:

a) This unit is interputed as correlative with the MacLean Granitic Pluton in the Long Lake Area (Wolff, 1978, 1979).
b) No relative age difference is implied between the Addington Pluton and the Northbrook Batholith.
c) No relative age is implied between these units.
d) The metamorpohic convention is used in naming these rocks wth the least plentiful mineral placed first.
e) Metamorphic textural terminology is after Spry (1969)/
f) Migmatite and anatectite terminology is after Mehnert (1971).

Table 2:

	M641-79-1	M606-79-1	M66-79-2	M535-79-2	M532-79-1
Quartz	37	58		10	
Plagioclase	25	12	45	35	36
	Sericitized	oligoclase		oligoclase	oligoclase
Orthoclase					
Biotite	25	15	9	11	19
Hornblende			34	28	35
Diopside	5	5		2	2
Almandine					
Garnet					
Muscovite		5			
Epidote					
Sphene					
Opaques	8	5	12	8	8
Total	100	100	100	100	100
	GRDR	PHASES	SCHLIEREN PHASE		MAP UNIT 1B
		MAP UNIT 1A			

Table 2:
MODAL ABUNDANCES MAP UNIT 1

M535-79-1	M1225-79-1	M630-79-1	M541-79-1	A293-79-1	M789-79-1
	12	50	45	25	57
32	41	39	32	9	22
labradorite	labradorite	sericitized		sericitized	labradorite
			18		
22	22	5		11	8
32	5				
2	8				
				55	
	5		3	5	
		3			
12	12	3	2	6	13
	100	100	100	100	100
	MAP	UNIT	1C PHASE	MAP UNIT 1d	Leucosome Map

Table 2:

	A275-79-1	M789-79-2	M1111-79-1
	34	8	
	27	18	8
	Labradorite	Labradorite	labradorite
			30
	23	12	
	8	56	
			12 augite
			35
	8	6	15
	100	100	100
	Phase nit le	Melanosome Phase	Map Unit IF

TABLE 3

Modal Abundances Map Unit 2

Sample	M052-79-1	A056-79-1	A064-79-1	M062-79-1
Hornblende	34		33	
Plagioclase	33	30	30	18
	sericitized	sericitized	oligoclase	oligoclase
Quartz	6	10	10	
Biotite	12			
Epidote		40		
Chlorite	8	10	15	
Talc				70
Calcite	4			
Sphene	4			
Tremolite				5
Opaque		10	12	7
Total	100	100	100	100
	Map Unit 2a		Map Unit 2b	Map Unit 2d

TABLE 4

Modal Abundances Map Unit 3

	M200-79-1	M290-79-1	MQ41-79-1	M260-79-2	M466-79-1	M1059-79-1
Quartz	15	10	26	76	71	78
Plagioclase	20 sericitized andesine	10 sericitized andesine	15 sericitized andesine			2
Hornblende	35	35	28			
Muscovite					23	18
Biotite	15	18	22	18		
Calcite		8			<1	
Apatite		6				
Tremolite		5				
Microcline					1	2
Talc			1			
Opaque	15	8	8		5	
Total	100	100	100	100	100	100
	Map Unit 3b				Map Unit 3c	

TABLE 5

Modal Abundances Map Unit 5

	M004-79-1	M499-79-1	M421-79-1	A176-79-1	M836-79-1	M1271-79-1
Plagioclase	42	40	28	22	18	25
	andesine	andesine	andesine to oligoclase			oligoclase
Hornblende	33	35	35	65	70	38
Biotitete	5		15		2	18
Calcite	8	18	15	5		
Quartz						14
Apatite	4			5		
Pyroxene			5 diopside			
Sphene		2	2			
Opaque	8	5		2	10	5
Total	100	100	100	100	100	100
	Map Units 5a, and 5ac			Map Unit 5b		Map Unit 5g

Table 6
LAVANT MAFIC INTRUSIVE
Modal Abundances of the GABBRO to PYROXENITE PHASES

	A070-79-1	M123-79-1	A067-79-1	A153-79-1	M089-79-2	A111-79-1	A119-79-1
Plagioclase	40 saussuritized	37 saussuritized labradorite	31 sericitized	53 oligoclase sericitized	35% oligoclase-labradorite	8% sericitized	8% oligoclase
Pyroxene							
CPX	7 Augite	32 Augite			4 Augite	15 Augite	50 diopside altering to amphibole (tremolite)
OPX	5 Hypersthene		5 Hypersthene				
Hornblende	43		22		22		
K-feldspar			8 Microcline	15 orthoclase	29 orthoclase sericitized		
Biotite			14	15		8	
Epidote		22		4	8		
Apatite		4					
Quartz			12				
Tremolite						59	
Olivine							30
Perovskite							4
Opaque	5	5	8	5	3	10	8
Total	100	100	100	100	100	100	100
	Map Unit 8a	Map Unit 8af	Map Unit 8d	Map Unit 8e	Map Unit 8g	Map Unit 8k	

Table 7
Modal Abundances of the FELSIC PHASES

	M253-79-1	M144-79-1	A104-79-1	A132-79-1	M144-79-2
Quartz	15	14	15	30	5
Plagioclase	39 heavily sericitized	35 sericitized oligoclase	32 sericitized	35 sericitized andesine	53 sericitized oligoclase
K-Feldspar		10 orthoclase	15 orthoclase	15 orthoclase	
Biotite	26	8	22	18	18
Hornblende		28	5		8
Garnete					12
Muscovite	8				
Apatite					1
Epidote				2	
Opaque	12	5	5		4
Total	100	100	100	100	100
	Map Unit 8i				Map Unit 8d

TABLE 8

LANARK-OSO MAFIC INTRUSIVE

Modal Abundances of the GABBRO - ANORTHOSITE - PYROXENITE PHASES

	M575-79-1	A481-79-1	M716-79-1	A362-79-1	A317-79-1
Plagioclase	42 labradorite	34 sericitized	91 labradorite	90 labradorite	91 labradorite
Pyroxene					
CPX	32 diopside			5 diopside	
OPX					
Hornblende		48			
Biotite	8	5	4		
Olivine	8				3
Sericite					
Muscovite		3		5	
Corundum			4		
Spinel					
Quartz					3
Opaque	10	10	1		3
Total	100	100	100	100	100
	Map Unit 8a			Map unit 8c	

Table 8:

	M656-79-1	M727-9H	M636-79-1	M657-79-1	M547-79-1	M657-79-2	A458-79-1
	90 labradorite	72 labradorite	82 labradorite	83 labradorite	75 labradorite	75 labradorite	5
	5 diopside			12 diopside	4 altering to hornblende	20 altered enstatite	32 enstatite
			10		12		20
		8		5	4		
			5				25
	5	20					
							10
			3		5	5	8
Total		100	100	100	100	100	100
	Map Unit 8b						Map Unit 8k

TABLE 9
Chemical Composition of Anorthosite Samples from the Lanark-Oso Mafic Intrusion (Weight Percent)

	A362-1	M677-1	A357-1	M360-1	M747-1	M716-1	M727-1	M656-1
SiO_2	50.3	50.5	47.6	46.8	47.1	48.6	50.6	46.2
Al_2O_3	30.3	29.8	30.4	32.7	31.8	30.2	23.9	31.6
Fe_2O_3*	0.89	1.16	1.15	0.57	1.11	1.99	4.94	1.06
MgO	0.75	0.96	1.07	0.51	0.93	1.31	3.32	1.02
CaO	12.2	13.0	13.0	15.3	15.0	12.8	9.47	13.2
Na_2O	3.45	3.58	3.02	2.31	2.24	3.03	4.48	2.46
K_2O	0.83	0.08	0.74	0.13	0.19	0.81	0.99	1.12
TiO_2	0.11	0.15	0.20	0.13	0.17	0.26	0.58	0.14
P_2O_5	0.04	0.03	0.04	0.04	0.04	0.05	0.04	0.10
MnO	0.02	0.01	0.02	0.01	0.02	0.02	0.03	0.02
CO_2	0.39	0.14	0.26	0.14	0.14	0.16	0.27	0.31
S	0.01	0.01	0.01	0.01	0.03	0.02	0.03	0.02
Lot	1.3	0.07	1.0	0.4	0.8	1.0	1.9	1.7
Total	100.2	99.9	98.2	98.9	99.4	100.0	100.2	98.6

* total is as reported as Fe_2O_3

TABLE 10

Comparison of Average Anorthosite Compositions and Residual Compositions from the Anatectic Melting of Tonalite

	A	B	C	D	E	F
SiO_2	70.31	68.28	55.81	48.5	54.6	53.62
Al_2O_3	17.26	18.74	26.40	30.8	25.1	27.31
TiO_2	0.22	0.26	0.22	0.21	1.3	0.79
FeO	1.69	2.22	1.87	1.87*	3.1	1.59
MgO	0.53	0.40	0.65	1.23	1.0	0.45
MnO	0.02	0.02	0.09	0.18	0.0	0.02
CaO	3.62	4.44	8.99	12.99	8.7	9.75
Na_2O	5.10	5.21	5.37	3.07	5.4	4.45
K_2O	1.12	0.43	0.67	0.61	0.7	0.71

A - Starting Material Tonalite T-50; B - Residual Composition after extraction of 25% anatectic melt at hematite-magnetite buffer; C - Residual composition after extraction of 75% anatectic melt; D - Average Lanark - Oso anorthosite composition (8 samples); E - Average Adirondacks anorthosite (Buddington, 1939); F - Average Lake Rouvary anorthosite (westernn Lac St. Jenn massif, after Kchlenbeck 1974).
* Total iron reported as Fe_2O_3.
Starting and Residual Tonalite Compositions after Fright Currie, 1976.

TABLE 11

MODAL ABUNDANCES

MAP UNIT 4 - LATE STAGE GRANITIC INTRUSIVES

	M231-79-1	M255-79-1	M519-79-1	M515-79-1	M473-79-1
Quartz	12	14	12	18	12
Plagioclase	35 oligoclase	35 oligoclase	47 oligoclase	60 oligoclase	53 albite
K-feldspar					
Microcline	15	25		12	
Orthoclase	8	8	12		35
Biotite	15	8	15	4	
Muscovite	1		2		
Hornblende		4			
Epidote	2				
Sphene	5				
Apatite		2			
Opaque	8	9	8	4	
Total	100	100	100	100	100
	Map unit 9a	Map unit 9b	Map unit 9c	Map unit 9d	

Table 11:

M258-79-1	A005-79-1	A031-79-1
8	38	35
16	28	35
oligoclase	albite	albite
20		
40	18 perthitic	20 perthitic
8	8	6
		4
2		
5	8	
100	100	100
Map Unit 9e	Map Unit 9j	Map Unit 9i

PHOTOGRAPH CAPTIONS

1) A photomicrograph of augen-bearing (protomylonite) granodiorite gneiss-metatexite of map unit 1a. Taken under plane-polarized light the augens are composed of plagioclase feldspar and appear white to greyish while the biotite defining the foliation-gneissosity is dark grey. The finer grained light material is quartz. This sample is M641-79-1 and was taken from an augen-rich zone adjacent to the healed fault zone near the contact of unit 1 and unit 9. The augen measures 2.5 mm in the long dimension.

2) A photomicrograph of a protomylonite from map unit 2 in the major shear zone near Clarendon Station (sample M070-79-1). Taken under plane polarized light this photo shows the very fine grained nature and small scale layering formed by the high shear stresses. The darkest material is pulverized pyrite grains, the medium grained material is biotite and hornblende while the lightest coloured grains are plagioclase and epidote. The photo covers a distance of 6 mm in the long dimension.

3) A view of finely laminated calcite marble map unit 4b looking northeastward along the foliation plane. The nodular features immediately to the left of the pick are calc-silicate (tremolite diopside) siliceous nodules map unit 4e; which occur locally in this unit. This outcrop is located on the east side of the gravel road running north from Zealand just south of Bolton Creek, Oso Township.

4) A typical outcrop view of anorthosite from map unit 8c in te Lanark-Oso mafic intrusive. This particular shot depicts one of the most contaminated zones the dark discontinuous wisps representing local concentrations of pyroxene. This particular outcrop was located on the north shore of Rock Lake.

5) Corundum-bearing phases of map unit 8c. Set within pure anorthosite these crystals are extremely euhedral and have a positive relief and usually weather black. Such corundum-bearing zones tend to be continuous along strike over distances of 1 km plus, but general across strike disappear within 100 m. This shot is from the north of Rock Lake.

6) The best exposed outcropping of map unit 10-diabase dyke cutting carbonate metasediments (map unit 4abeg) at the junction of Highways 509 and 7. The dike is 125 m west of the junction on the north side of Highway 7, and cuts the metasediments at a low angle.

7 & 8) These photos are from the same outcrop only meters apart and are an attempt to photograph the boudin-clasts or "pseudo-conglomerates" which are produced within map unit 3 between quartzite and less quartz-rich lithologies by the deformation sequence of boudinage, followed by rodding and culminated by brittle fracture. Both photos depict short and medium length boudin-clasts which can subsequently be traced along strike into continuous beds. This outcrop is located along the power lne some 800 m north of Highway 7 west of Silver Lake in Oso Township.

9 & 10) An excellent outcropping of the boudin-clast feature at the White Lake Rearing Station (western boundary of the map-area). The outcrop of interest is located west of the path at the base of a small rise about half-way between the main office and the boathouse on White Lake. Photo 9 clearly shows the heavily rodded nature of the clasts while photo 10 depicts the variety of clast size and shape. The clasts of this location are primarily quartzite and/or metamorphosed quartz wacke set in a muscovitic quartzofeldspathic paragneiss and finely bounded quartzite (unit 3caf).

Photo 1. Photomicrograph of augen-bearing granodiorite gneiss-metatexite of map unit 1a.

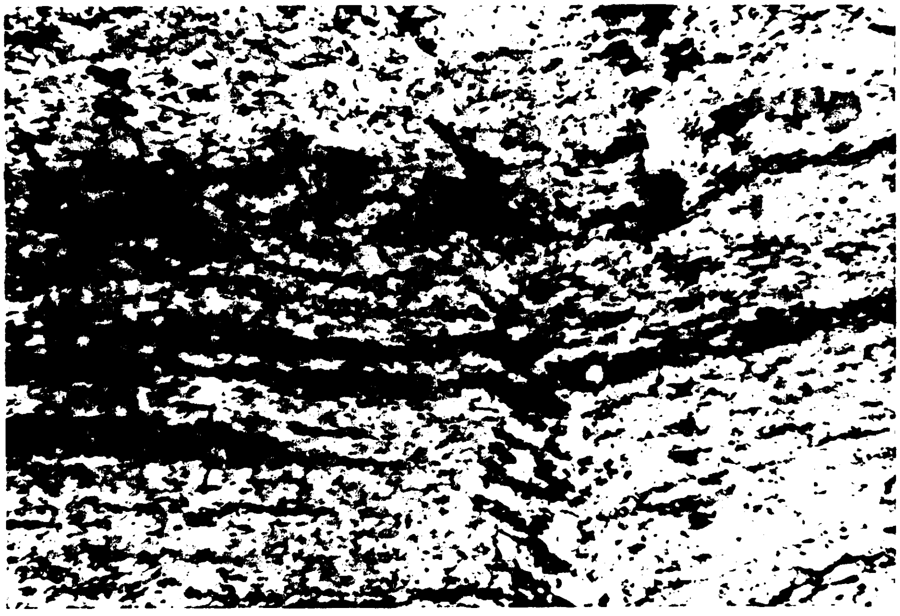


Photo 2. Photomicrograph of a protomylonite from map unit 2.

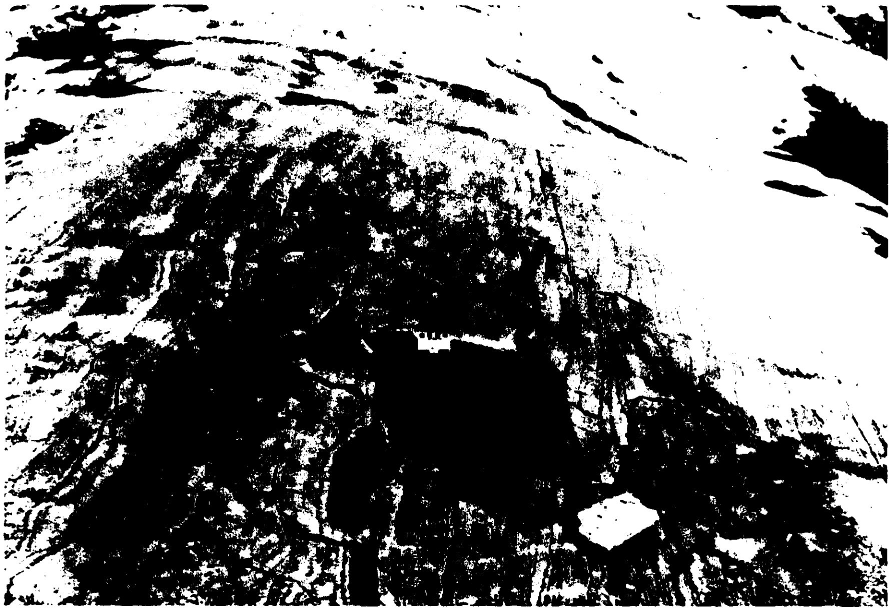


Photo 3. Finely laminated calcite marble map unit 4b.

Photo 4. Outcrop view of anorthosite from map unit 8c in the Lamark-Oso mafic intrusive.

Photo 5. Corundum bearing phases of map unit 8c.

Photo 6. Map unit 10 diabase dyke cutting carbonate metasediments (map unit 4a b e g).

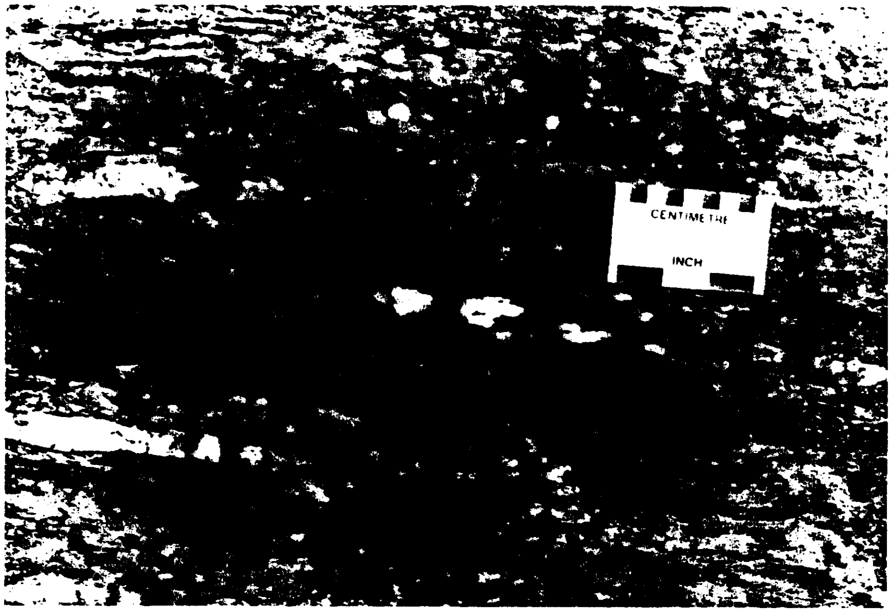


Photo 7. Boudin-clasts or "pseudo-conglomerates" from map unit 3.

Photo 8. Boudin-clasts or "pseudo-conglomerates" from map unit 3.

Photo 9. Boudin-clasts or "pseudo-conglomerates" from map unit 3.

Photo 10. Boudin-clasts or "pseudo-conglomerates" from map unit 3.

FIGURE CAPTIONS

1) Comparison of Lanark-Oso Anorthosite Geochemistry with that of other Grenville Anorthosites. Lanark-Oso values are the mean and range based on 8 samples; Nain, Norin and Marcy anorthosite values are after deWaard, 1968; Lac St. Jean value is after Kehlenbeck, 1974.
2) Metamorphic Pressure Temperature Composite indicating pertinent metamorphic zones and isograds in the Sharbot Lake (after Winkler, 1976).
3) ACF Diagram for the Clinopyroxene-Almandine-Quartz-Granolite subzone of the regional hypersthene zone (after Winkler, 1976).
4) Deformation Stages Required for "Boudin-Clast" Formation.

FIG#1

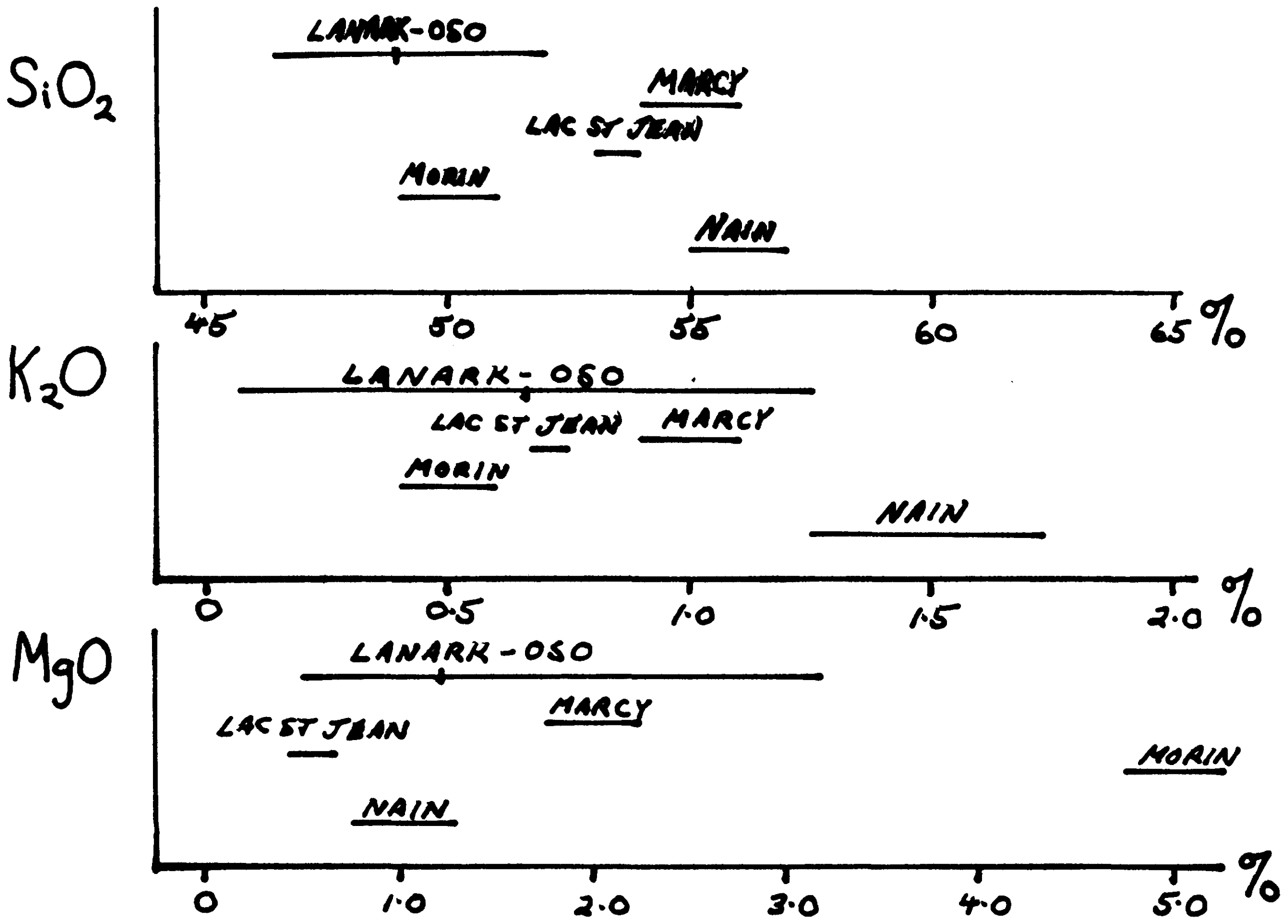


Fig 1. Comparison of Lamark-Oso Anorthosites with that of other Grenville Anorthosites.

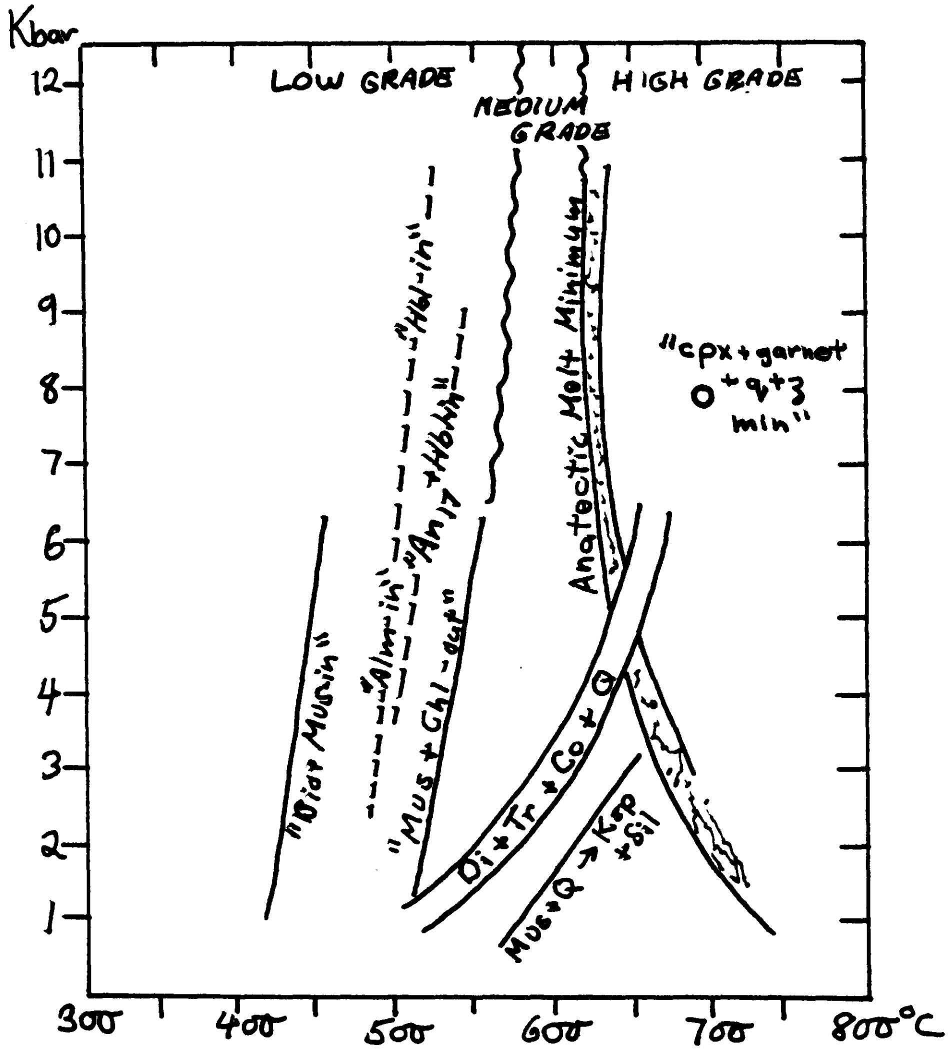


Fig. 2 Metamorphic Pressure Temperature Composite indicating pertinent metamorphic zones and isograds in the Sharbot Lake Area.

FIG #3

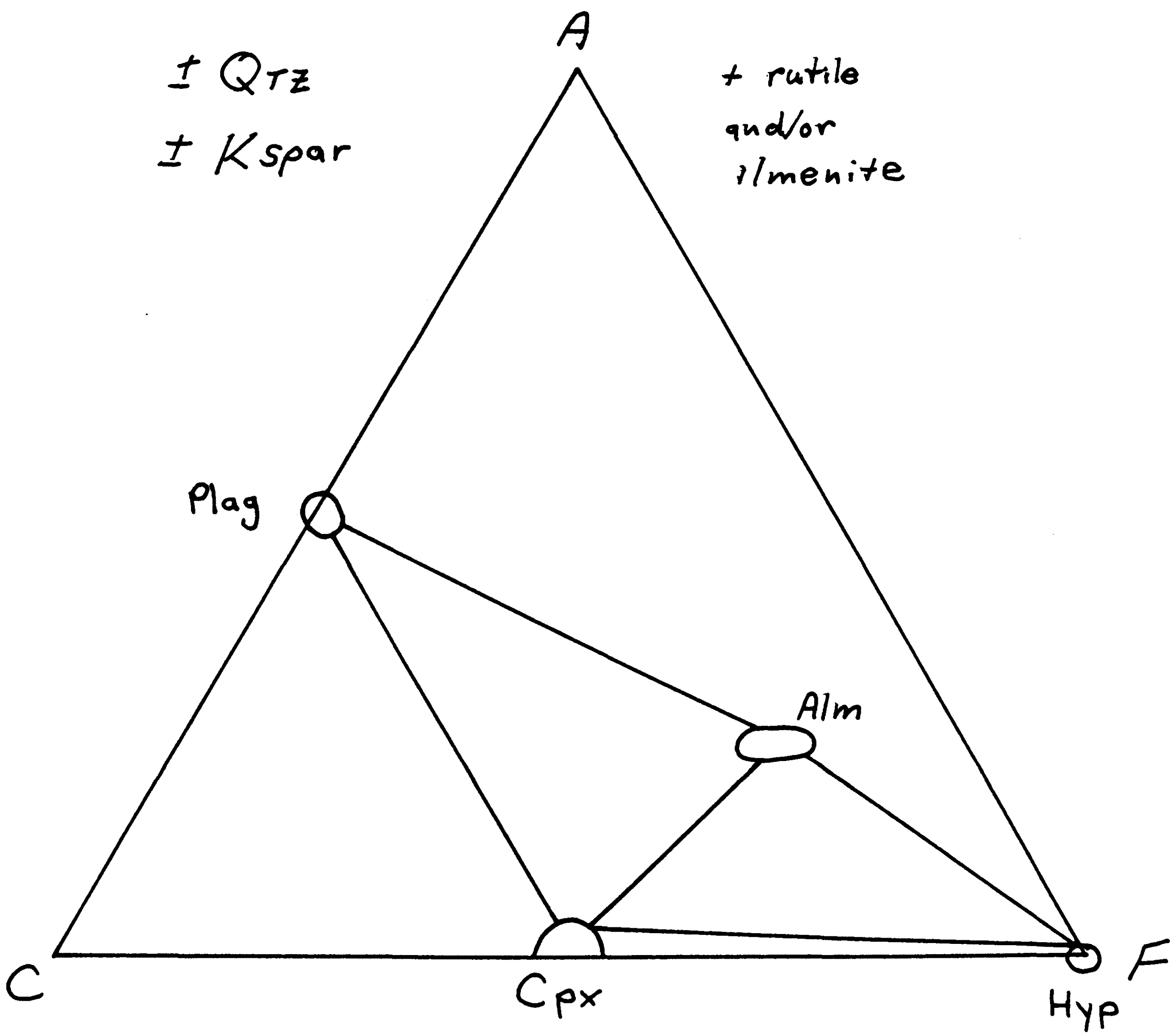


Fig 3. ACF Diagram for the Clinopyroxene-Almandine-Quartz-Granolite subzone of the regional hypersthene zone.

FIG. #4

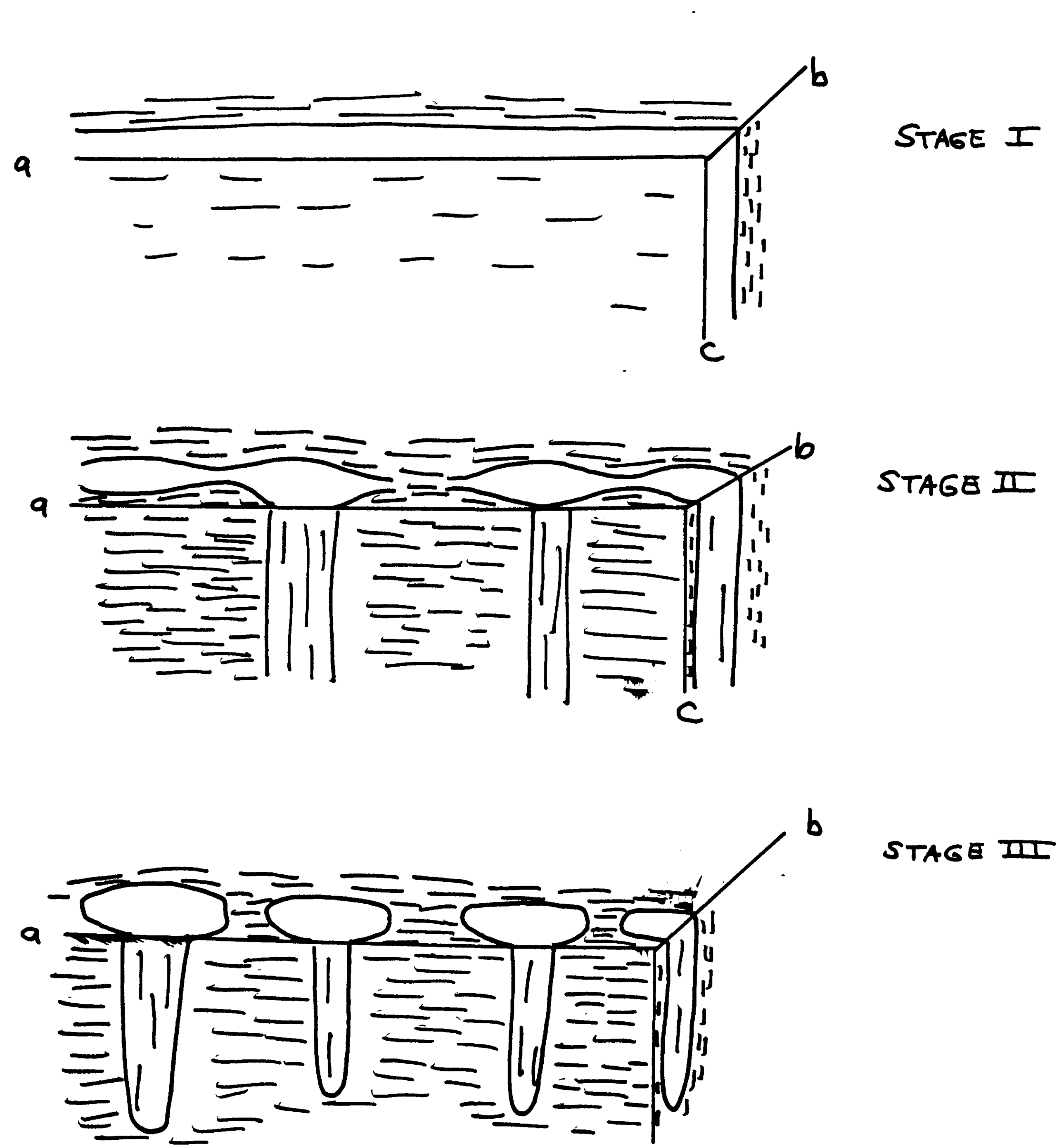
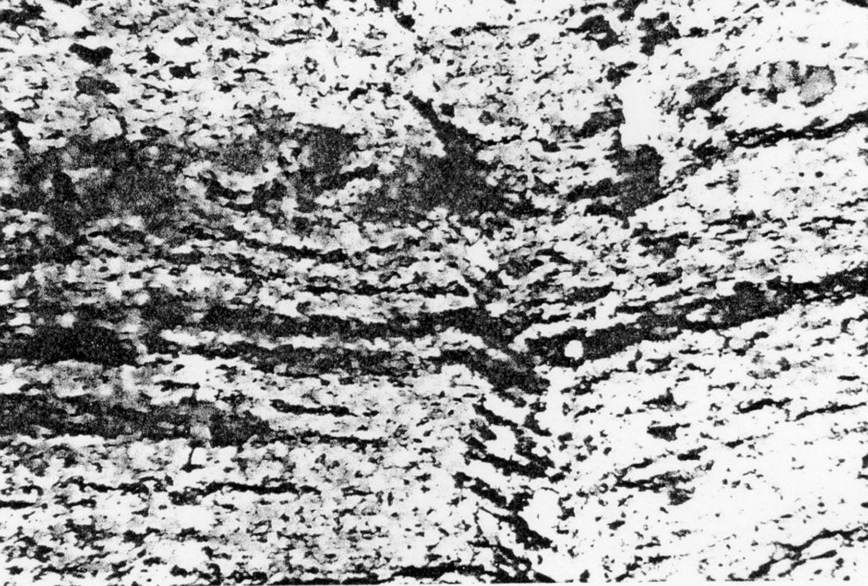
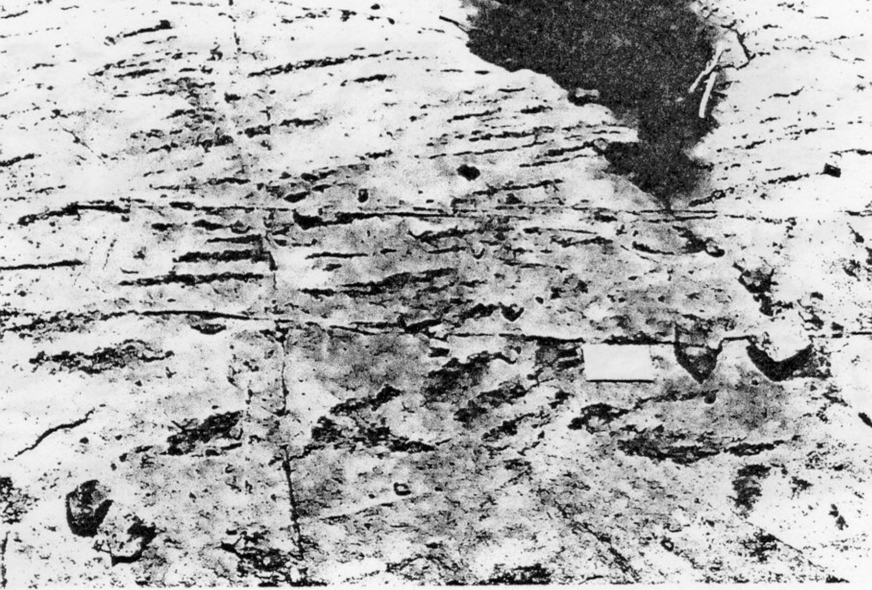
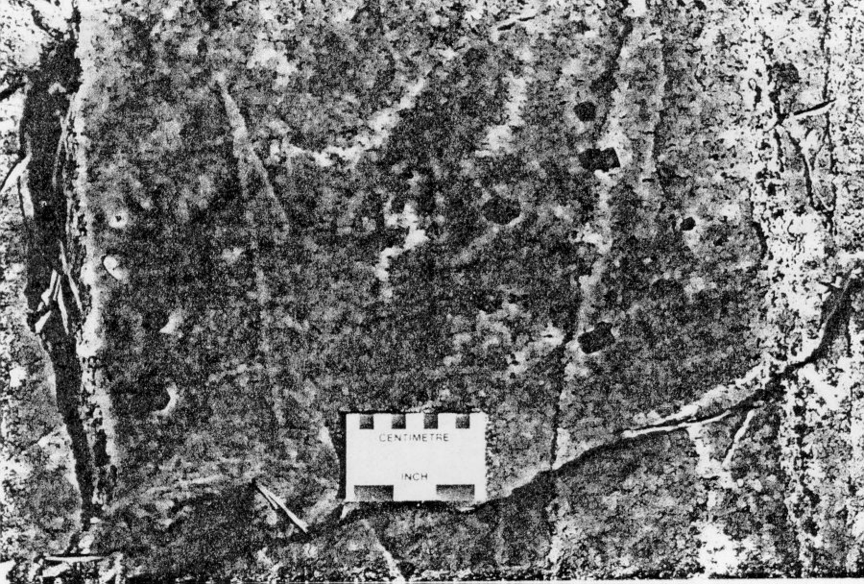


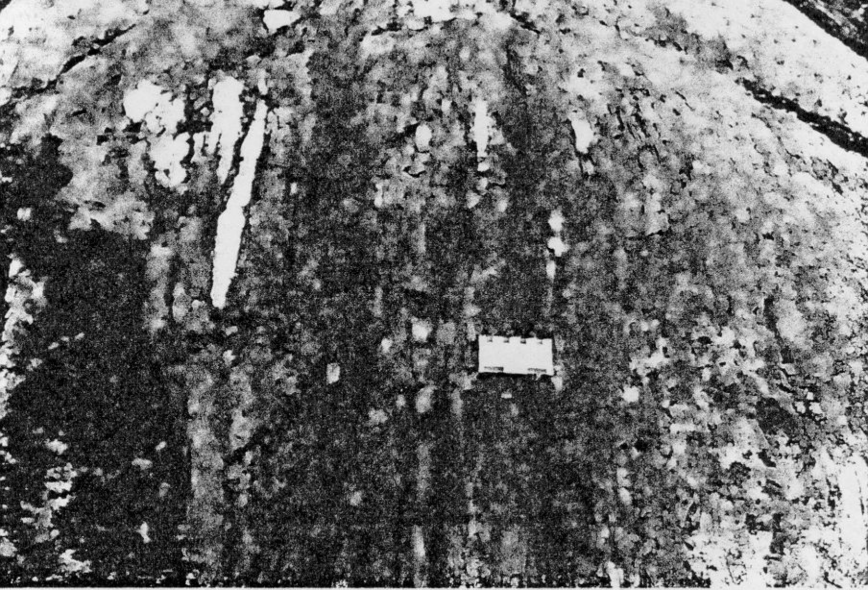
Fig 4. Deformation Stages Required for "Boudin - Clast" Formation.

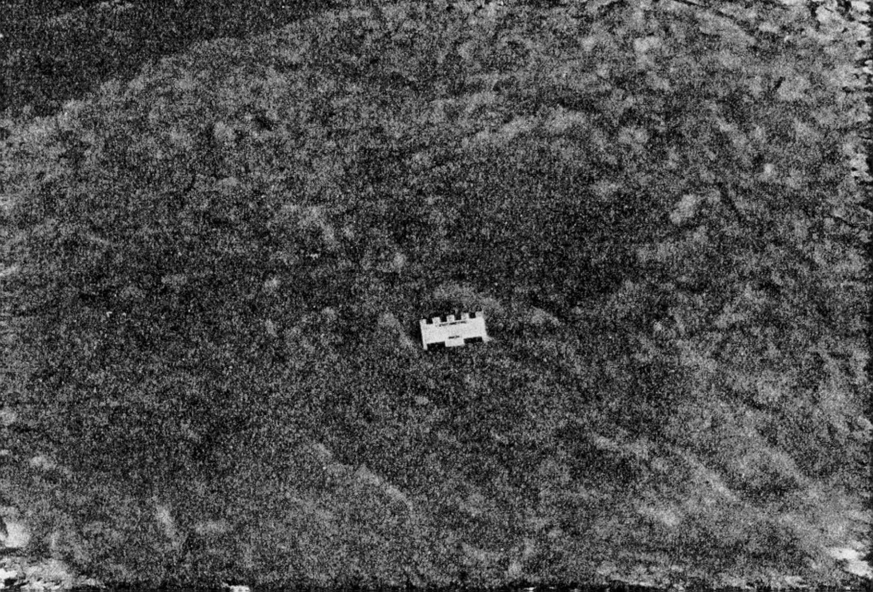


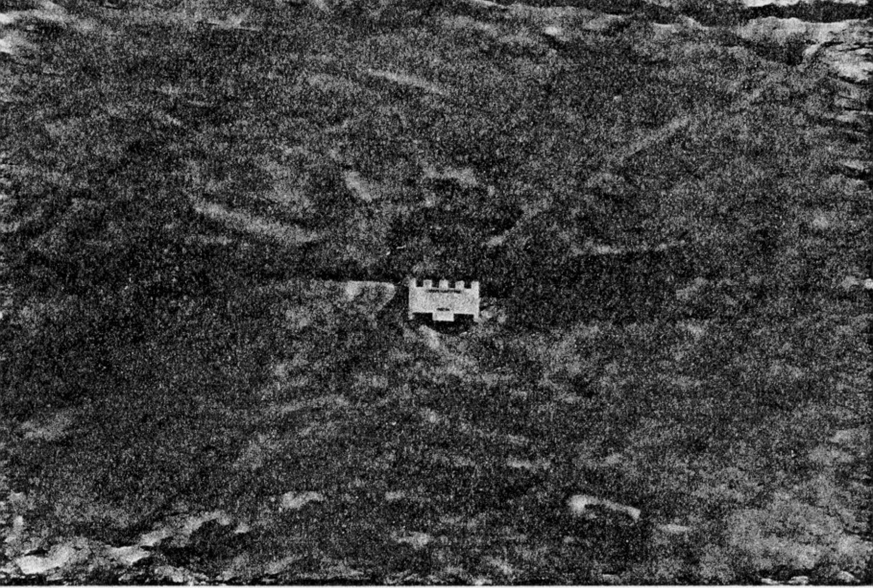


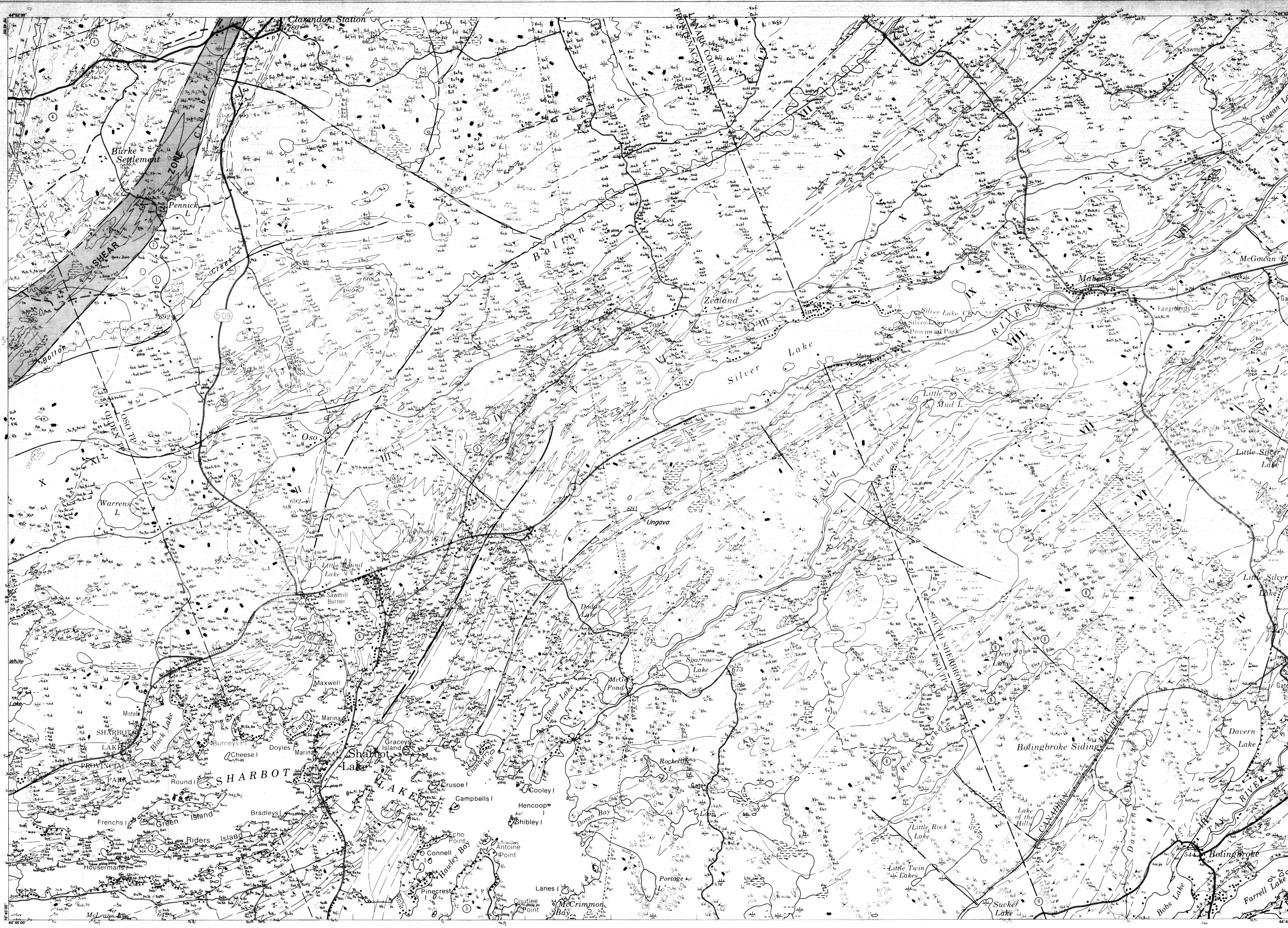

CENTIMETRE
INCH


CENTIMETRE
INCH









Ministry of Natural Resources
Ontario

Hon. James A. C. Auld
Minister
Dr. J. K. Reynolds
Deputy Minister

ONTARIO GEOLOGICAL SURVEY
PRELIMINARY MAP P. 2373
GEOLOGICAL SERIES

SHARBOT LAKE AREA

SOUTHERN ONTARIO

Scale: 1: 15 840

Mile ¼ 0 ¼ ½ Mile
Metres 100 0 0.2 0.4 0.6 0.8 1 Kilometre

NTS Reference: 31C/15
ODM-GSC Aeromagnetic Map: 69G

LEGEND[a]

PHANEROZOIC
CENOZOIC
QUATERNARY
RECENT
Organic swamp and alluvial deposits

PLEISTOCENE
Outwash deposits, sand silt, clay and till

PRECAMBRIAN
LATE PRECAMBRIAN
LATE TECTONIC METAMORPHOSED INTRUSIVE ROCKS
LATE MAFIC INTRUSIVE ROCKS

10 — 10 Mafic (diabase) dikes

INTRUSIVE CONTACT

LATE GRANITIC INTRUSIVE ROCKS[b]

9
- 9a Fine to medium-grained, massive to foliated, biotite granite, quartz monzonite (biotite ⩾15 percent)
- 9b Medium to coarse-grained, equigranular, massive, biotite granite, quartz monzonite (biotite < 10 percent)
- 9c Fine to medium-grained, massive to foliated, biotite granodiorite
- 9d Fine-grained, leucocratic granite
- 9e Medium-grained, massive to foliated, syenite ± hornblende ± biotite ± epidote.
- 9f Porphyritic (quartz or feldspar phenocrysts) varieties of 9b
- 9g Muscovite-bearing varieties of above rock types
- 9h Shear zone granite and granodiorite phases including protomylonite, mylonite, and mylonite gneiss ± porphyroclasts, usually containing epidote
- 9i Pink granitic pegmatite dikes and irregular masses/sills, locally containing tourmaline ± biotite ± muscovite
- 9j White granitic pegmatite dikes and irregular masses/sills, locally containing muscovite ± biotite ± garnet
- 9k Unsubdivided metasedimentary and metavolcanic inclusions, (mainly assimilated material from units 2 and 3)
- 9L Quartz veins and dilation fillings ± magnetite

INTRUSIVE CONTACT

EARLY MAFIC INTRUSIVE ROCKS
Lavant and Lanark-Oso Mafic Intrusions

8
- 8a Medium to coarse-grained gabbro (CI > 30)
- 8b Medium to coarse-grained anorthositic gabbro, gabbroic anorthosite (CI 10-30)
- 8c Medim to coarse-grained anorthosite (CI < 10)
- 8d Medium-grained quartz gabbro
- 8e Medium to coarse-grained monzonite phases
- 8f Fine-grained varieties of 8a
- 8g Syenite-bearing phases of above rock types
- 8h Porphyroblastic, glomeroporphyroblastic phases
- 8i Medium-grained biotite granodiorite phases
- 8j Aplitic granodiorite phases
- 8k Coarse-grained pyroxenite

FAULT AND/OR INTRUSIVE CONTACT

SYNTECTONIC METAMORPHOSED FELSIC TO INTERMEDIATE INTRUSIVE ROCKS
Addington Pluton[c]

7
- 7a Foliated to gneissic, medium-grained, leucocratic quartz monzonite
- 7b Shear zone quartz monzonite-granodiorite phases including protomylonite, mylonite, and mylonite gneiss ± porphyroclasts usually containing epidote
- 7c Foliated to gneissic, medium-grained, biotite quartz monzonite (biotite < 25%)
- 7d Weakly foliated, leucocratic, medium-grained pink granite
- 7e Foliated to gneissic, medium-grained, biotite granodiorite (biotite > 25%)

Northbrook Batholith[c]

6 — 6a Lineated to weakly foliated, medium-grained biotite trondhjemite

FAULT AND/OR INTRUSIVE CONTACT

METASEDIMENTS AND METAVOLCANICS
Amphibole-Rich Gneisses and Schists[d,e,f]

5
- 5a Foliated, fine to medium-grained, subidioblastic plagioclase-hornblende gneiss locally boudinaged ± biotite ± epidote
- 5b Massive, medium to coarse-grained, idioblastic, amphibolite ± plagioclase (possibly gabbro)
- 5c Calcite porphyroblasts and/or calcite layers locally occurring in unit 5a
- 5d Biotite-chlorite schist
- 5e Biotite-hornblende schist
- 5f Foliated, fine to medium-grained, subidioblastic hornblende-plagioclase gneiss, locally boudinaged ± biotite ± epidote
- 5g Fine to medium-grained, granoblastic, quartz-plagioclase-hornblende gneiss
- 5h Foliated, fine to medium-grained, subidioblastic plagioclase-hornblende gneiss (80% hornblende)
- 5i Foliated, fine to medium-grained, K-feldspar-hornblende gneiss
- 5j Almandine garnet porphyroblasts in units 5a, f, g
- 5k Biotite-hornblende-quartzo-feldspathic schist
- 5L Shear zone phases of above units including, protomylonite, mylonite and mylonite gneiss ± porphyroblasts

Carbonate Metasediments[d,e,f]

4
- 4a Medium to coarse-grained, granoblastic, calcite marble
- 4b Fine to medium-grained, granoblastic, laminated calcite marble (0.5 to 2 cm thick layers)
- 4c Medium-grained, granoblastic, dolomite-marble
- 4d Medium-grained, granoblastic, dolomite-calcite marble
- 4e Fine to medium-grained, subidioblastic, calcsilicate assemblages containing tremolite, diopside, talc
- 4f Fragmental, dolomite-calcite marble, containing flags of quartzite, quartz and calc-silicate (unit 4e material)
- 4g Quartzite, quartzo-feldspathic blocks, broken beds and flags
- 4h Chert beds (5 cm thick)
- 4i Mafic hornblende-rich segmented layers
- 4j Coarse-grained (2 cm) varieties of 4a, c, d
- 4k Contact skarn phases containing tremolite, diopside, apatite, talc
- 4L Calcite-graphite schist

Clastic Siliceous Gneisses and Schists[d,e,f]

3
- 3a Foliated, granoblastic, fine to medium-grained, biotite-quartz-feldspar paragneiss (biotite 10-35%)
- 3b Foliated, granoblastic, fine to medium-grained, biotite-hornblende-plagioclase-quartz paragneiss
- 3c Fine-grained banded quartzite ± biotite ± feldspar (0.5 to 2 cm thick layers)
- 3d Foliated, granoblastic, fine to medium-grained, epidote-biotite-potassium feldspar-plagiocase-quartz paragneiss
- 3e Pyritic varieties of 3d, rusty quartzo-feldspathic paragneiss
- 3f Muscovite-bearing varieties of units 3a, 3c
- 3g Muscovite-quartzo-feldspathic schist ± garnet
- 3h Foliated fine to medium-grained biotite, calcite, quartzo-feldspathic paragneiss, locally schistose
- 3i Garnetiferous porphyroblastic varieties of units 3b, 3d
- 3j Shear zone phases of above units including protomylonite, mylonite, and mylonite gneiss
- 3k Leucocratic, foliated, granoblastic, fine-grained biotite-magnetite-muscovite-quartzo-feldspathic gneiss

Mafic to Intermediate Metavolcanics[d,e,f]

2
- 2a Foliated, subidioblastic, fine-grained, quartz-epidote-plagioclase-hornblende amphibolite and amphibolitic gneisses, gneissic varieties usually have up to 20% biotite (CI > 35)
- 2b Foliated, subidioblastic, fine to medium-grained, epidote-plagioclase-hornblende amphibolite, containing porphyroblasts of hornblende (CI > 35)
- 2c Foliated subidioblastic, fine-grained, biotite-hornblende quartzo-feldspathic ash tuff (CI = 15-30)
- 2d Fine-grained talc, serpentine, calcite schist
- 2e Shear zone phases of above units including protomylonite, mylonite and mylonite gneiss, porphyroblasts, locally containing K-feldspar

Mafic to Silicic Migmatites and Anatectic Gneisses[g]

1
- 1a Medium to coarse-grained granodiorite gneiss, locally augen bearing and contains inclusions of unit 1b and schlieren (CI < 20)
- 1b Medium to coarse-grained hornblende-plagioclase (labradorite)-pyroxene diatexite usually augen bearing (plagioclase) displaying a stromatitic structure
- 1c Fine-grained quartz-feldspar gneiss ± biotite ± pyrite
- 1d Medium-grained quartz-plagioclase-biotite ± pyroxene ± garnet gneiss
- 1e Well differentiated migmatite containing a fine to medium-grained leucosome of quartz and feldspar and a fine to medium-grained melanosome of hornblende-plagioclase-biotite, displays distinctive stromatitic structure-metatexite
- 1f Medium-grained quartz-plagioclase-biotite ± hornblende ± pyroxene, diorite to granodiorite in composition displaying a stromatitic structure and no xenoliths or schlieren, diatexite
- 1g Medium-grained gabbroic gneiss ± biotite ± hornblende
- 1h Coarse-grained pegmatite segregations paralleling gneissosity

NOTES
- a) This is basically a field legend and may be changed as a result of subsequent laboratory investigations
- b) This unit is interpreted as correlative with the McLean Granitic Pluton in the Long Lake Area (Wolff, 1978, 1979).
- c) No relative age difference is implied between the Addington Pluton and the Northbrook Batholith.
- d) No relative age is implied between these units.
- e) The metamorphic convention is used in naming these rocks with the least plentiful mineral placed first.
- f) Metamorphic textural terminology is after Spry (1969).
- g) Migmatite and anatectite terminology is after Mehnert (1971).

MARGINAL NOTES

LOCATION AND ACCESS

The Sharbot Lake Area covers 250 km^2 and is bounded by Longitudes 76° 30'W and 76° 45'W and Latitudes 44° 45'N and 44° 52' 30''N. The village of Sharbot Lake is located in the southwest part of the area 2 km. north of the southern boundary on Highway 38.

Road access to the field area is excellent via Highways 7, 38 and 509 plus a large number of secondary roads. Sharbot Lake and White Lake provide excellent water access in the southwestern part of the area.

In 1979 the writer completed detailed mapping of the Sharbot Lake Area as part of the continued detailed mapping of the southern Grenville structural province (Central Metasedimentary Belt, Wynne-Edwards 1972), especially the Frontenac Axis frontier zone (Wolff 1978, 1979).

MINERAL EXPLORATION

Mineral exploration in the map-area has been active during five major periods. The first period circa 1900 saw the interest in vein-type apatite for phosphate extraction. This resulted in the operation of a number of small pits south of Silver Lake, by small private operators (Spence 1920; Harding 1947), yielding 250 tons of phosphate. In addition the search for iron in this period indicated some small showings on the northeast shore of White Lake, but no economical concentrations were delineated (Harding 1947).

The second period circa 1910 was concentrated on the search for mica and feldspar. A number of small prospect pits for mica were sunk in the map-area. The largest of these, the Wm. Hawley occurrence (3) yielded about 1 ton of marginal quality mica (Harding 1947). A number of small prospect pits for feldspar were also examined at this time in the map-area, none of which became commercial (Harding 1947; Hewitt 1964).

The third period of exploration circa 1940 concentrated on the prospecting for gold in southeastern Ontario. A number of minor test pits were sunk in the map-area. Invariably these pits encountered pyritiferous late-stage quartz veins. Three of these occurrences contained less than 0.01 ounces gold per ton, and include the Bourk (1), McVeigh (5), and Marrow (6) occurrences (Harding 1947). None of these showings produced economical concentrations.

The fourth period of exploration circa 1959 involved exploration for base metals and gold. Cremac Surveys Co. Ltd. (2) reported nine hundred and forty feet of drill core from three holes located in metasediments on the shore of Sharbot Lake. These indicated non-economic Ni, Cu, and Au values (Assessment Files Research Office, Ontario Geological Survey, Toronto).

The most recent period of exploration activity in the map-area is from 1977-79. The focus has been centered upon potential uraniferous zones delinated by the joint Federal-Provincial Uranium Reconnaissance project (GSC, 1976, 1979), and earlier geophysical surveys by the Keevil Mining Group (1969) (4). The zones of highest potential are indicated to lie just to the north of the present map-area northwest of Clarendon Station.

GENERAL GEOLOGY

The bedrock of the area is composed of a number of different stratified and massive lithologies. The oldest rocks in the area are considered to be the metasediments and metavolcanics and high grade gneisses of similar mineralogy. The gneiss units are comprised of well differentiated migmatites with a well defined stromatitic texture, metatexite; granodiorite gneiss ± augens ± schleiren; hornblende-plagioclase-pyroxene diatexite; quartz-plagioclase-biotite garnet gneiss; and gabbroic to dioritic gneiss. Migmatite and anatectite terminology is after Mehnert (1971). The supracrustal rocks which grade into the above gneisses are composed of three distinctive types; 1) mafic to intermediate metavolcanics 2) clastic siliceous metasediments and 3) carbonate metasediments. The supracrustal units form a distinctive series of rocks which pass northeastwards through Sharbot Lake, while the high grade gneisses are located southeast of these supracrustal rocks between Bolingbroke and Sharbot Lake.

The above gneissic and supracrustal assemblages have been intruded by several bodies of mafic and felsic intrusives. An early stage of felsic plutonism is represented by the Addington Pluton and Northbrook Batholith (Wolff 1978, 1979). These bodies are chiefly granodiorite to quartz monzonite, and trondhjemite, respectively in the Sharbot Lake Area. These bodies are located in the very northwest corner of the map-area. Subsequent to these intrusions a period of mafic intrusion followed by a late stage felsic period is indicated by a number of bodies. The mafic intrusions are composed of two distinct, but likely contemporaneous bodies, the Lavant gabbro and the Lanark anorthosite. The Lavant gabbro is composed of fine grained gabbro and gabbroic anorthosite with carbonate material as large-scale inclusions (which suggests that this is a high level intrusion with remnant roof pendants). The Lanark anorthosite, contains very minor amounts of gabbro (less than 15 percent exposed) and abundant anorthosite and gabbroic anorthosite. Textures of the Lanark body suggest it to be a deeper level intrusion than the Lavant intrusion. The felsic phase of the late stage intrusive event includes massive to weakly foliated rocks varying from granodiorite to quartz monzonite to granite with granodiorite to granite pegmatite dikes and massive quartz veins.

Stratigraphic thicknesses are difficult to ascertain due to a high degree of infolding in the stratiform rocks and preservation of few top indicators. The supracrustal rocks have been metamorphosed to the medium-high temperature fields of medium grade metamorphism, while the gneisses are metamorphosed to the low temperature field of high grade metamorphism (metamorphic fields after Winkler 1976).

Pleistocene outwash deposits including sand, silt, clay and till dot the area, with a rather prominent glacial outwash spillway being defined by the present day Bolton Creek Valley.

STRUCTURAL GEOLOGY

The Sharbot Lake Area contains a variation of structural components. The clastic siliceous and carbonate metasediments are exposed in a generally northeast trending zone which extends from Mountain Grove (south and west of the map area) to Maberly. The general strike trend of these units is northeast (N40°E to N60°E) with moderate dips (25°-55°S). This foliation is considered to be essentially parallel to the bedding. The units are folded into isoclinal folds which plunge shallowly (25°-35°) northeast (N40°E) and are essentially axial planar to the major fold axis. In the vicinity of Sharbot Lake these units are warped by an intrusion of the late stage felsic episode into a shallow "S" shaped structure. Evidence for slippage during this deformation is indicated by the common presence of quartz and hornblende rodding lineations (130°/35°) which are essentially a dip-slip component. Boudinage coupled with bed fracture and severe rodding in the more quartz-rich units in these metasediments creates a number of outcrops which upon superficial examination may be mistaken for conglomerate units. The high grade gneisses occur immediately south and east of the above metasediments and display a similar northeast-southwest trend. The mafic intrusions and late stage felsic intrusions are essentially structureless, except for local weak foliations parallel to country rock attitudes near the contacts. The above rock types are structurally separated from the early stage felsic intrusions by a major late stage shear zone trending north-northeast and south-southwest. This shear zone contains protomylonites, mylonites and mylonite gneiss and is an extension of the shear zone which passes through Mountain Grove (Wolff 1979). This shear zone is important as it represents the eastern limit of the Clare River Synform (Schwerdtner 1977; Wolff 1978). Results of the 1979 field season indicate this shear zone to clearly truncate the Clare River Synform, thus this structural entity does not occur in the map-area. The movement on the shear appears to be primarily dip-slip with the relative movement being west side up and east side down, i.e.). a normal dip-slip fault. The shear zone strikes N5°E and dips 65°E.

Jointing is best expressed in the intrusive rocks and generally trends southeast-northwest, or north-south with essentially vertical dips. Minor faulting appears to parallel the southeast trending joint set and late stage quartz veins are found to parallel both joint sets.

ECONOMIC GEOLOGY

The economic non-metallic mineral potential of the map-area is considered by the author to be very high, especially for the minerals talc, feldspar and garnet.

Located on the west-half of lot 25, concession II, Oso Township, just west of Pennick Lake (7), the field party discovered a unit of talc-tremolite-serpentine-calcite schist striking north enclosed by metasediments and metavolcanic units. Preliminary investigation indicated the zone to be some 100 m in width with along strike dimensions reaching 500 m. This unit is readily accessible and well exposed and may prove to be a feasible body to exploit. A similar deposit is currently being extracted by Ram Petroleums Ltd. at the talc-tremolite plant south of Robertsville on Highway 509, north of Clarendon Station.

Possible economic deposits of feldspar exist in the very clean anorthosite portions of the Lanark anorthosite (Rock Lake-Deer Lake Occurrence, (8)). This large occurrence is located on lots 6-13 concession VI South Sherbrooke Township, Lanark County and lots 7 and 8 concessions VI and VIII Oso Township, Frontenac County. Large portions of this body are extremely feldspar-rich (95%) and further results are pending laboratory investigation of these units. This is a well exposed and readily accessible by road occurrence.

Possible economic deposits of garnet are found in the gneiss units west of Bolingbroke (Sucker Lake Occurrence (9)). These gneisses contain well differentiated beds of garnet, biotite, and quartz-feldspar (garnet locally 80% plus). Garnet units have a maxium thickness of 0.5 m but are continuous along strike over several hundred metres and beds often repeat within 5-10 m across strike. These units are located on the north-half of lots 3, 4, 5 concession III, and the south-half of lots 3, 4, 5 concession IV, South Sherbrooke Township, Lanark County, and lots 3 and 4 concession VIII, Oso Township, Frontenac County.

The vein-type apatite bodies south of Silver Lake were completely exhausted by the earlier operations and similar deposits are not known to occur elsewhere in the field area. The gold and base metal bearing test pits and diamond drill holes of the recorded exploration work (Assessment Files) were typically located in metasedimentary units. The sporadic distribution of these units provides no indication of gold-bearing controls. The uranium anomalies are centered north of the map-area and equivalent rocks within the map-area show no anomalous values.

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LIST OF PROPERTIES AND OCCURRENCES

1) Bourk R.T. Occurrence
2) Cremac Surveys Ltd. [1959]*
3) Hawley Wm. Occurrence
4) Keevil Mining Group
5) McVeigh R. Occurrence
6) Marrow A. Occurrence
7) Pennick Lake Occurrence
8) Rock Lake - Deer Lake Occurrence
9) Sucker Lake Occurrence

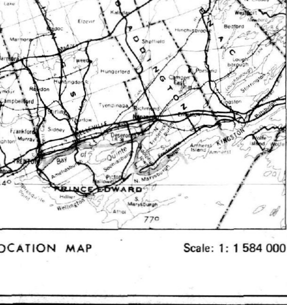
*Date in square brackets signifies last date of exploration activity.

MINERAL AND METAL ABBREVIATIONS

ap	Apatite	gf	Graphite
bio	Biotite	hem	Hematite
Cu	Copper	mi	Mica
cor	Corundum	Ni	Nickel
fel	Feldspar	phlog	Phlogopite
gt	Garnet	py	Pyrite
Au	Gold	talc	Talc

SYMBOLS

Small bedrock outcrop.
Area of bedrock outcrop.
Gneissosity, (horizontal, inclined, vertical).
Foliation; (horizontal, inclined, vertical).
Lineation with plunge.
Geological boundary, observed.
Geological boundary, position interpreted.
Lineament.
Jointing; (horizontal, inclined, vertical).
Drill hole; (vertical, inclined)



LOCATION MAP Scale: 1: 1 584 000

SOURCES OF INFORMATION

Geology by J.M. Wolff and assistants, 1979.
Base map derived from the Forest Resources Inventory Maps, Lands and Waters Group, Ontario Ministry of Natural Resources, with additional information by J.M. Wolff.

Geology is not tied to surveyed lines.
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Magnetic declination was 10° 26' W. in 1979.

Every possible effort has been made to ensure the accuracy of the information presented on this map; however, the Ontario Ministry of Natural Resources does not assume any liability for errors that may occur. Users may wish to verify critical information; sources include both the references listed here, and information on file at the Resident or Regional Geologist's office and the Mining Recorder's office nearest the map area.

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