LEGEND

DEVONO-CARBONIFEROUS

DClmED — **EAST DALHOUSIE LEUCOMONZOGRANITE:** Textural variations include fine-to medium-grained moderately equigranular, porphyritic and slightly megacrystic. Modal concentrations of biotite (<2-7%), muscovite (1-4%) and cordierite (tr-2%) are highly variable.

DClmMH — **MICKEY HILL LEUCOMONZOGRANITE:** contains biotite (4-7%), muscovite (tr-4%), (pinitized) cordierite (tr-2%) and has a porphyritic texture. Biotite has a bimodal grain size and is commonly chloritized.

DCmgWD — **WEST DALHOUSIE MONZOGRANITE:** fine-to medium-grained moderately equigranular to weakly porphyritic, sometimes containing biotite (6-14%), muscovite (tr-3%), and cordierite (tr-4%). The cordierite is invariably pinitized and may be locally abundant (<4% large cm^3 blocky cordierite crystals).

area of megacrystic texture. Modal mineralogy same as moderately equigranular textured phase.

DCmgLR — **LITTLE ROUND LAKE MONZOGRANITE:** mostly medium-to coarse-grained, K-feldspar megacrystic and contains biotite (12-16%), muscovite (tr-1%) and cordierite (tr-1%). Small (≤10 cm^3) xenoliths are common.

DCmgSC — **SCRAG LAKE MONZOGRANITE:** medium-to coarse-grained, K-feldspar megacrystic (5-15%) to porphyritic. Unit contains, biotite (11-16%), (invariably pinitized) cordierite (tr-2%) and muscovite (tr).

area of predominately porphyritic texture

DCgdSG — **SCRAG LAKE GRANODIORITE:** medium-to coarse-grained moderately equigranular to K-feldspar megacrystic (5-15%). Contains biotite (14-18%) and trace amounts of muscovite and pinitized cordierite. Small (<10 cm^3) xenoliths are common.

DCgdL — **LEQUILLE GRANODIORITE:** characterized by a fine-to coarse-grained, seriate-to medium-grained, moderately equigranular texture and a high biotite content (16-24%). Small rounded xenoliths are also common.

DCmp — **MAFIC PORPHYRY:** medium-grained moderately equigranular in texture and contains abundant biotite (>20%) dark grey in colour and small (≤ 5cm^3) xenoliths are abundant.

DEVONIAN

Dt — **TORBROOK FORMATION:** shale, siltstone, quartzite, commonly reddish brown dark grey

SYMBOLS
(not all symbols occur on map)

Rock outcrop, area of outcrop, probable outcrop, float.....

Geological boundary (defined, approximate, assumed, defined by till clasts).....

Geological boundary–gradational (- 100 m; -100 m).....

Exposed intrusive contact (arrow pointing toward younger unit, age relation not determined).....

Unconformity (hatching on younger side).....

Limit of mineralogical or textural variation.....

Bedding (horizontal, inclined, vertical, overturned, dip unknown, younger direction unknown).....

Anticline (defined, approximate).....

Syncline (defined, approximate).....

Preferred orientation of feldspar megacrysts (horizontal, inclined, vertical, dip unknown).....

Schistosity, gneissosity, cleavage, foliation (horizontal, inclined, vertical, dip unknown).....

Breccia.....

Schlieren banding (horizontal, inclined, vertical, dip unknown) poorly developed isolated bands and well developed (thin and heavy lines respectively).....

Lineament (from air photos).....

Fault (defined, approximate, assumed, inclined, vertical).....

Fault (sinistral, dextral).....

Shearing and intense fracturing, fracture cleavage (horizontal, inclined, vertical, dip unknown).....

Joint (horizontal, inclined, vertical, dip unknown).....

Dyke or vein: ALBI–albitite; APPG–aplite with minor pegmatite; DIAB–diabase; ELVA–elvan; LUGR–leucogranite; LUMZ–leucomonzogranite; LUPO–leucoporphyry; MIAP–mica aplite; PGAP–pegmatite with minor aplite; PEGM–pegmatite; PEGMZ–zoned pegmatite; PORP–porphyry; QTZ–quartz (indicated if mineralized); all unlabelled dykes are aplites; -1 m–thin lines, -1 m–heavy lines (inclined, horizontal, vertical, dip unknown).....

Stockwork (type indicated).....

Sheeted complex (type indicated).....

Area of abundant dyking (type or map unit indicated).....

Gneiss: -1 m, -1 m (indicated if mineralized).....

Megacryst–rich areas.....

Xenoliths (-1 m, -10 m, concentration of xenoliths) map unit indicated when known.....

Diamond–drill hole/reference number from N.S.D.M.E. Open File Report.....

Trench, adit, shaft.....

Mineral occurrence (commodities indicated at top; number on bottom refers to marginal notes or N.S.D.M.E. mineral occurrence cards).....

Mine or Prospect.....

Quarry.....

Alteration: ALB–albitization; CHL–chloritization; DES–desilicification; HAA–high alumina; HEM–hematization; KAO–kaolinization; LIM–limonitization; POT–potassic (which include biotitization and K–feldspathization); SAU–saussuritization; intense and pervasive in capitals, slight to moderate in lower case.....

LIST OF COMMON MINERAL ABBREVIATIONS

ad–andalusite; am–amethyst; ap–apatite; as–arsenopyrite; au–autunite; bo–bornite; ca–calcite; cc–chalcocite; ks–cassiterite; cp–chalcopyrite; ch–chlorite; cd–cordierite; cy–chrysocolla; fl–fluorite; gn–galena; gr–garnet; he–hematite; il–ilmenite; ka–kaolinite; ma–malachite; mn–manganese minerals; mo–molybdenite; mu–muscovite; py–pyrrhotite; py–pyrite; sh–scheelite; si–sillimanite; sp–sphalerite; se–sericite; to–tobernite; tr–tourmaline; wo–wolframite.

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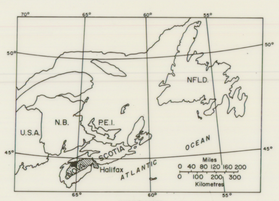
Figure 1



Location Map

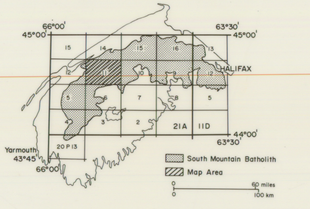
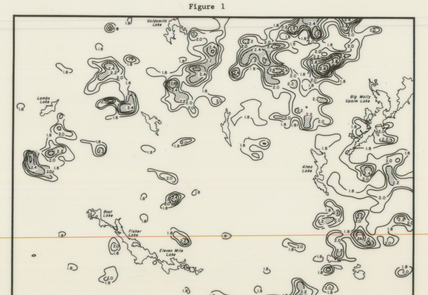


Figure 2



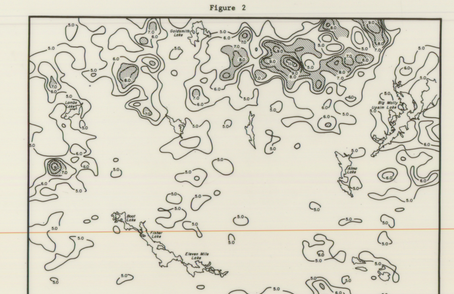
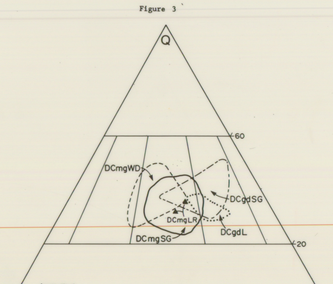


Figure 3



DESCRIPTIVE NOTES

INTRODUCTION

The purpose of this survey was to map the granitic rocks of South Mountain Batholith (SMB) in a consistent and systematic manner focusing on their texture, mineralogy, alteration and spatial relationships. Based upon these parameters and using the classification scheme of Streckeisen (1976), eight (8) rock units were delineated in the map area, and include; granodiorite[1], monzogranite[1], leucomonzogranite[2], leucogranite[3] and syenogranite[1]. The systematic staining of rock samples using sodium-cobaltinitrate together with external point counting of feldspars are critical for distinguishing between the above rock types (see QAP-Fig 3). Percentages of biotite, muscovite and cordierite used in unit descriptions are derived from point counts (observed proportions) and visual modal estimates (muscovite). The interpretation of bedrock geology for the map area is based on and is a continuance of bedrock geology determined by MacDonald et al.(1988) for the surrounding SMB.

Previous geological mapping within this map area was restricted in scope and did not include a regional perspective (Faribault, 1939; Taylor, 1969). McKenzie (1974) was the first to map the SMB on a regional scale incorporating petrographic observations.

UNIT DESCRIPTIONS (from most to least biotite content)

MAFIC PORPHYRY (DCmp)

The only exposure of this unit occurs in the NE portion of the map sheet approximately 2 km. south of Lequille on Highway 8 at the intersection with Highway 101. It is dark grey, medium-grained porphyritic to moderately equigranular and contains abundant biotite (>20%). Small (≤ 5cm^3), rounded xenoliths are common. Although the contact of this unit with the adjacent Lequille Granodiorite is not exposed, the transition occurs over < 1m. and it is assumed to be intrusive (intrusive) because of the absence of the intense shearing and alteration observed within the adjacent granodiorite unit (see below).

LEQUILLE GRANODIORITE (DCgdL)

Occurring in the same area as the mafic porphyry, this unit is characterized by a fine-to coarse-grained seriate to medium-grained moderately equigranular texture and a high biotite content (16-24%). Small rounded xenoliths are also common. Although predominately of granodiorite composition, several outcrops north of Grand Lake Flowage are monzogranitic. While this suggests that the unit may be compositionally heterogenous, the effects of alteration can not be discounted due to the presence of locally intense shearing and fracture- controlled alteration (hematization, chloritization, calcitization, K-feldspathization). Although speculative, this unit may represent a marginal phase of the Scrag Lake Granodiorite.

South of Highway 101 in the Grand Lake Flowage area, large blocks of reddish-brown (hematized) and dark-grey silstones and quartzites of the Torbrook and(or) White Rock Formations occur within the granodiorite.

SCRAG LAKE GRANODIORITE (DCgdSG)

This unit occurs in the NE and NW portions of the map sheet. In the NE area, around Big Molly Upsim Lake, this unit has a medium-to coarse-grained moderately equigranular to megacrystic[4] (5-10%) texture and contains biotite (14-18%) with trace amounts (<1%) of muscovite and pinitized cordierite. Small (<10 cm^3) xenoliths are common. Exposures of this unit from Big Molly Upsim Lake to approximately 5 km. south in the area of Beaver Lakes display intense shearing and alteration (hematization, chloritization). These affects are associated with prominent faults (see Structure below).

In contrast, exposures of DCgdSG in the NW corner of the map sheet are medium-to mostly coarse-grained, megacrystic (10-15%) and contain less xenoliths. Biotite, muscovite and cordierite contents are similar to those in the NE area; with the exception of the Lambs Lake area where approximately 3% large (≤1.0 cm) blocky cordierite crystals occur. Exposures along the west branch of Round Hill Brook (approx. 5 km east of Lequille) are intensely sheared and hematized and have been intruded by several leucogranite dykes. K-feldspar megacrysts in both areas commonly display (pseudo)rapikivi textures.

It is important to note that (as within the Lequille Granodiorite) extensive point-counting has revealed these two areas contain zones of monzogranite (see DCmgSG). Based on this survey the occurrence of monzogranite appears to be erratically distributed within this unit and is usually too small to be represented at the scale of mapping. An exception to this is along Big Molly Upsim Lake where a distinct mappable area of monzogranite occurs. The interested reader is refered to Horne (1989) for a complete discussion regarding temporal relationship of granodiorite and biotite monzogranite within the SMB.

SCRAG LAKE MONZOGRANITE (DCmgSC)

This unit underlies approximately 50% of the map. It is medium-to coarse-grained, megacrystic (5-15%), and contains biotite (11-16%), (pinite) cordierite (< 2%) and trace muscovite. As mentioned above this unit can only be distinguished from DCgdSC through staining and point-counting.

While a megacrystic texture is dominant within this unit, a porphyritic variation also occurs. The best exposure of porphyry is in the vicinity of Frog and Gull Lakes (south-central portion of map sheet). Although a large area is defined on the map as being porphyry, the area actually varies from well developed (with quartz and K-feldspar phenocrysts) to slightly porphyritic. Outcrops exhibiting a similar porphyry texture occur along the SE end of Fisher Lake and Long Lake and the east shore of Mulgrave Lake (SW corner of the map sheet). The occurrence of porphyry NE of Gull Lake is also inferred by the presence of porphyry clasts in local till (Finck et al., in prep). Contact relationships of the porphyry with the megacrystic phase appear to be gradational over several meters, however an intrusive relationship is also suggested by the occurrence of a small porphyry dyke in the area of Snowshoe Lakes (SE of Frog Lake). The contact of this unit with DCgdSG was not observed but may be gradational as determined to the NE on 21A/15 (MacDonald & Ham, 1988).

LITTLE ROUND LAKE MONZOGRANITE (DCmgLR)

This unit is located in the SE portion of the map sheet. It is mostly medium-to coarse-grained, megacrystic and contains biotite (12-16%), muscovite (tr-1%) and large, blocky cordierite (tr-1%). Small (≤10 cm^3) xenoliths are common. Although adjacent to DCmgSG in the SE portion of the map sheet no contacts with external were observed. The presence of intense shearing and alteration within both units near their assumed contact suggests that these two units are in fault contact. Intense NE-trending shearing is also observed within this unit south of DClmED (see below) which is also intensely sheared. A sharp intrusive contact between this unit (DCmgLR) and DClmED is exposed on a trail north of Round Lake. determined by MacDonald et al.(1988)

WEST DALHOUSIE MONZOGRANITE (DCmgWD)

This unit occurs as three seperate bodies which traverse the north half of the map sheet. Two textural types have been indentified. The most abundant type is fine-to medium-grained moderately equigranular. The other is a highly megacrystic phase, characterized by the presence of abundant (20-40%) uniformly sized (1x3 cm.) K-feldspar megacrysts. Rapikivi textures are common and locally the megacrysts may display a NE (60°) alignment.

Both textural variations contain similar amounts of biotite (6-14%), muscovite (tr-3%) and cordierite (tr-4%). The cordierite is invariably pinitized and may be locally abundant as observed approximately 2 km. west of West Dalhousie where 4% large (1cm^3), blocky cordierite crystals occur within the megacrystic portion of this unit. The presence of fine-grained bladed biotite is diagnostic of this unit, particularly for the moderately equigranular (non-megacrystic) phase.

Alteration effects within this unit are best developed within the moderately equigranular phase which often has a light-orange colouration attributed to pervasive hematization (deuteric?). This alteration is most intense east of Hannamville where quartz grains and plagioclase feldspar cores are bright-red.

Sharp intrusive contacts were observed at several locations between this unit and DCmgSC. No contacts, however, were observed between this unit and granodiorite (DCgdL, DCgdSG). This unit is intruded by and spacially associated with several leucomonzogranite bodies (DClmED; see below).

MICKEY HILL LEUCOMONZOGRANITE (DClmMH)

This unit occurs as a small (< 3km^2), discrete body in the NW portion of the map sheet within DCmgSC. The areal extent of this leucomonzogranite in the map sheet is based solely on angular rubble (sub) crop and till clast occurrences because of an absence of outcrop. This unit contains biotite (4-7%), muscovite (tr-4%), (pinitized) cordierite (tr-2%) and has a porphyritic texture. Phenocrysts of plagioclase and quartz occur within a K-feldspar-rich groundmass. The biotite has a bimodal distribution and is commonly chloritized. Although no contacts were observed between this unit and the Scrag Lake granodiorite, a porphyry dyke of similar composition (with the exception of 2% cordierite) was observed within the Lequille Granodiorite north of Highway 101.

Hematization within this unit fs reflected by dark-red plagioclase cores and a pervasive red colouration of the rock where more intense. Several boulders are also muscovite/sericite enriched, probably reflecting the effects of greisenization.

EAST DALHOUSIE LEUCOMONZOGRANITE (DClmED)

Exposures of this unit are scattered throughout the map sheet, and commonly occur as small (≤ 2km^2), discrete, intrusive bodies. The largest exposure of this unit is in the SW corner of the map sheet where it displays textural and compositional characteristics similar to those of the type location for this unit described by Horne (1987) on map sheet 21A/10. Textural variations include fine-to medium-grained moderately equigranular, porphyritic to slightly megacrystic. Variations in modal mineralogy such as muscovite (1-4%), cordierite (tr-2%) and biotite (<2-7%) are common and are reflected by the range in composition from leucomonzogranite to leucogranite. This unit displays intense NE-fracturing and fracture-controlled hydrothermal alteration zones (hematization, K-feldspathization, chloritization). Syenogranite and leucogranite rock occur within this unit as dyke-like bodies oriented parallel to fracture orientation (NE) and often display gradational contacts.

The occurrence of abundant angular rubble of fault breccia and hematized fault gouge along Durland Lake Brook indicates the presence of a major shear zone. The presence of relatively undeformed leucogranite and quartz-stockwork rubble along the fault zone suggests that the zone was utilized by later magmatic and hydrothermal activity. Although the area of most intense deformation and alteration is less than 50 m wide, intense fracturing and fracture-controlled alteration occurs throughout DClmED and DCmgLR units in this area. The zone probably marks the SW extension of the East Dalhousie Fault Zone delineated and described by Horne (1987) and MacDonald and Ham (1988). In the current study, the fault zone appears to define the contact between DClmED and DCmgSG, and DCmgSC and DCmgLR. A sharp intrusive contact between DClmED and DCmgLR is exposed along a lumber road north of Round Lake. Other exposures of DClmED throughout the map area commonly display sharp intrusive contacts with their host rock and exhibit textural, mineralogical and alteration characteristics similar to those described for this unit in the Round Lake area. Tourmaline-bearing pegmatite segregations also occur within this unit, as observed in a gravel pit SW of Frog Lake in the south-central portion of the map sheet.

STRUCTURE

The prominence of structural features within the map sheet are reflected by air photo, geological and physiographical features. Lakes and streams commonly follow distinct linear trends and in many cases show abrupt (90°) course changes. These features indicate a dominate NE and NW fracture pattern within the underlying bedrock. This fracture pattern is corroborated by the orientation of air photo lineaments and bedrock features (joints, dykes).

There are several major NE-trending fault (shear) zones in the map area. The best exposed is the Molly Upsim Fault Zone (MUFZ) in the upper NE portion of the map sheet. It is 15 m wide and is well exposed for approximately 10 km on McGill and Big Molly Upsim lakes. The fault zone is marked by intense brittle deformation (fault and microbreccias) and metasomatic-hydrothermal alteration (hematization, chloritization). Hematized and silica-rich aphanitic microgranite(elvan?) public occurs within the fault zone at Kelly Lake off the SW end of Big Molly Upsim Lake.

Another brittle fault zone is proposed, approximately 6 km south of the MUFZ. This fault has been termed the Beaver Lakes Fault (BLF) and has an inferred strike length of approximately 20 km based on airphoto and physiographic features and the linear occurrence of deformed subcrop near Beaver Lakes. The Beaver Lakes Fault has the same NE trend as the MUFZ and displays similar deformation and alteration features.

Another 5 km south of the BLF occurs the East Dalhousie Fault Zone (as described above).

AIRBORNE SPECTROMETRY

The role of airborne spectrometric data in geological mapping and delineating granophile mineralization and associated alteration within the SMB is well documented (Chatterjee and Muecke, 1982; Ford and O'Reilly, 1985; Corey, 1988; O'Reilly et al., 1988).

Rocks of the SMB display a trend of increasing U and decreasing Th with differentiation (i.e. from granodiorite to monzogranite to leucomonzogranite).

Figures 1 and 2 display the equivalent U and equivalent Th response respectively for the map area. Unit DCmgWD has the highest values of uranium and thorium in the map sheet. This signature is atypical compared to similar rocks in the SMB east of this map sheet, possibly indicating different source regions. In contrast, DClmED in the SE corner of the map sheet displays high U and low Th, a response typical for leucomonzogranite. Smaller exposures of DCmgD which lack such a signature may do so for a variety of reasons (O'Reilly et al., 1988).

The discrimination of less fractionated granodiorite and biotite-monzogranite rocks using airborne spectrometry is best achieved by study of equivalent Th/equivalent K data; where granodiorite usually has a higher ratio value (Horne et al., 1989).

MINERAL OCCURRENCES

1. **Lambs Lake:** Disseminated uranium (oxides and phosphates) with associated copper, zinc and silver mineralization occurs within intensely altered (hematized, carbonitized) and fractured Torbrook Formation metasediment roof pendants in the vicinity of Graywood Gump, located east of Grand Lake along Highway 8. Prospecting, trenching and extensive diamond drilling conducted by Shell Canada Resources Ltd. (Dickie, 1979; Dakers, 1982) encountered several narrow (< 1m), fracture-controlled zones of mineralization.
2. **Hannam Lake:** This showing is located approximately 2 km SE of Hannamville by Hannam Lake. Minor disseminated pyrite and chalcopyrite occur within a extensive zone (10 m x 25 m) of quartz stockwork.
3. **Handsaw Lakes:** Disseminated scheelite grains occur within the heavy mineral fraction of a till sample (Finck et al., in prep). The sample was taken from a local granite till and contained clasts of porphyritic monzogranite similar to that exposed to the south between Gull and Frog Lakes.

[1]**Granodiorite- Monzogranite- Syenogranite;** after Streckeisen (1976).

[2]**Leucomonzogranite:** A rock of monzogranite composition with less than 6% combined mafic minerals.

[3]**Leucogranite:** A granitoid rock with less that 2% combined mafic minerals.

[4]**Megacryst:** A non genetic term for a crystal that is significantly larger than the surrounding groundmass. In the South Mountain Batholith megacrysts are predominantly subhedral to euhedral K-feldspar, and rarely plagioclase, crystals (generally between 2.5-7 cm in length) in medium- to coarse-grained rocks. ad). megacrystic.

[5]**Porphyry:** A rock with predominantly fine grained groundmass and medium- to coarse-grained phenocrysts (i.e. bimodal grain size distribution). Phenocrysts rarely exceed 2 cm. adj. porphyritic.

ACKNOWLEDGMENTS

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OPEN FILE MAP 89-014
PRELIMINARY GEOLOGICAL MAP OF
MILFORD
NTS SHEET 21A/11

M.C. COREY and R.J. HORNE

Kilometres 0 1 2 3 4
Miles 0 1 2
1:50,000

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