Musquodoboit Batholith Project and the Geology of NTS Map Area 11D/15 (Tangier)

L. J. Ham

Introduction

The Musquodoboit Batholith is the second largest granitoid pluton (~800 km²) in the Meguma Terrane of mainland Nova Scotia (Fig. 1). The batholith intruded Cambro-Ordovician metasedimentary rocks of the Meguma Group ca. 370 Ma (Clarke and Halliday, 1980; Reynolds et al., 1981). The body roughly parallels the coastline, extending east of Halifax to Sheet Harbour, and covers parts of three NTS map areas, 11D/13, 11D/14 and 11D/15.

Bedrock mapping of the batholith was initiated to compare its lithology and mineralogy with the larger (~7300 km²) South Mountain Batholith of southern Nova Scotia (Fig. 1). Results of the mapping project were plotted digitally on 1:10 000 scale maps which were subsequently compiled (maps and databases) using AutoCad® and Fieldlog® to create 1:50 000 scale maps. Portions of the batholith that crop out on NTS 11D/13 have been illustrated in two open file maps that were released in 1998 (Minerals and Energy Branch Open File Maps 1998-5 and 1998-9). Maps of NTS areas 11D/14 and 11D/15 were released in 1999 (Ham, 1999a, 1999b) and results have been previously discussed for 11D/14 (Ham, 1999c). This report discusses the main features of NTS map area 11D/15 and illustrates those results in Figure 2.

Previous Work

The boundaries of the Musquodoboit Batholith were outlined by Fletcher and Faribault (1887); however, no attempt to re-map the batholith was undertaken until the

Figure 1. Simplified geological map of the Meguma Zone showing locations of the Musquodoboit Batholith (MB) and the South Mountain Batholith (SMB). The boundary between the Meguma and Avalon zones is marked by the Cobequid-Chedabucto Fault System (CCFS). Abbreviations on the inset map are: Avalon Zone (A), Dunnage Zone (D), Gander Zone (G), Humber Zone (H) and Meguma Zone (MZ), representing zones of the Appalachians from Williams (1979).
1970s, when McKenzie and MacGillivary (1974) did work as part of a larger project comparing granites along the Eastern Shore. This work was followed by Jones and MacMichael (1976), who mapped a portion of the batholith. MacDonald (1981) studied the entire batholith as part of an M.Sc. thesis at Dalhousie University and subsequently reported on the results (MacDonald and Clarke, 1985).

**Results of Mapping**

The units are subdivided following the methodology and terminology used by the Nova Scotia Department of Natural Resources (NSDNR) for the South Mountain Batholith (e.g., MacDonald et al., 1992). Based on field mapping, geochemistry and thin section petrography, the Musquodoboit Batholith can be subdivided lithologically into four distinct units. These units are described below in the assumed order of oldest to youngest, based on cross-cutting relationships, and illustrated in Figure 2.

**Medium- to Coarse-grained Biotite Monzogranite**

The apparently oldest rock type is a buff-white and pink, medium- to coarse-grained (locally K-feldspar megacrystic) biotite monzogranite. This unit contains biotite (6-12%), muscovite (trace - 1%) and cordierite (trace - 1%). Two narrow bodies of biotite monzogranite occur adjacent to the observed contact with metasedimentary rocks of the Meguma Group (Fig. 2), similar to the unit’s distribution on NTS area 11D/14 (Ham, 1999c). A localized body of biotite monzogranite occurs in the Cowan Mill Pond area, at an embayment of the granite/metasedimentary rock contact. Another area of biotite monzogranite occurs on the eastern edge of Tangier Grand Lake, where contact-related phenomena occur, such as metasedimentary inclusions, xenoliths and biotite schlieren, as discussed in Ham (1997). All of these areas have associated polymetallic mineral occurrences (Fig. 2). Localized areas within the main body of the medium- to coarse-grained leucogranite contain increased amounts of biotite. These rocks are classified as biotite monzogranite, but are exposed over limited areas and are not illustrated on the map.

**Medium- to Coarse-grained Leucogranite**

The most abundant rock type in the map area is buff-white to pink, medium- to coarse-grained (locally K-feldspar megacrystic) biotite leucogranite. It is mineralogically similar to the biotite monzogranite, but contains less biotite (4-8%, average 6%). This unit has only trace amounts of muscovite, thus differing from leucogranite of the South Mountain Batholith which contains 3-10% muscovite. Cordierite is generally present (trace-2%) in all leucogranitic rocks, and euhedral, blocky cordierite grains range in size from 0.3 cm - 1 cm in length. There are mappable areas underlying NTS 11D/14 that have increased modal percentages of cordierite (up to 4%; Ham, 1999c); however, no such concentrations are recognizable within NTS map area 11D/15.

**’Specialized’ Leucogranite**

Texturally and mineralogically variable leucogranite occurs in several localities in the map area. Grain size ranges from fine- to medium-grained and textures vary from equigranular to porphyritic and pegmatitic. Airborne gamma-ray spectrometric surveys identified some of these rocks as having high equivalent uranium/equivalent thorium ratios (eU/eTh; Ford, 1991; Ham, 1993). These bodies were further defined by geological mapping and are shown in Figure 2.

**’Specialized’ leucogranite bodies are generally located in the central portion of NTS area 11D/15 (Fig. 2) and have high muscovite contents (2-4%), low biotite contents (trace -2%), and are generally medium- to coarse-grained with textural variability (e.g. fine grained, aplite) noted on individual outcrops. Other textural varieties exist and range from fine grained to local areas of pronounced porphyritic texture (phenocrysts of K-feldspar, larger grains of biotite, rosettes of muscovite). The rocks are termed ‘specialized’ because of their high eU/eTh and high degree of textural and mineralogical variability.**

**Fine- to Medium-grained Leucogranite**

This unit in the eastern portion of NTS map area 11D/15 consists of a small body (~1 km²) of buff-white to pink and red, fine- to medium-grained, equigranular leucogranite occurring at the junction of Tangier Lake with Tangier River along the southern contact of the batholith (Fig. 2). This leucogranite was not outlined by the airborne gamma-ray spectrometric survey (Ford, 1991) as a ‘specialized’ leucogranite and generally does not contain elevated uranium/thorium ratios, or the extreme variability in texture or mineralogy. For these reasons it was not considered one of the ‘specialized’ bodies.
Summary

The Musquodoboit Batholith can be classified using the same terminology as used for the South Mountain Batholith, although the medium- to coarse-grained leucosome-granite of the Musquodoboit Batholith is muscovite-poor compared with similar rocks of the South Mountain Batholith. The rock types are:
(1) medium- to coarse-grained biotite monzogranite, which occurs adjacent to contacts with metasedimentary Meguma Group rocks; (2) medium- to coarse-grained biotite and biotite-cordierite leucosome-granite, which comprises the main unit of the batholith; (3) ‘specialized’ leucosome-granite, which occurs in numerous, small bodies characterized by textural and mineralogical variability and other differences (decrease in grain size to fine grained, increase in muscovite content, porphyritic texture) from the coarser-grained leucosome-granite; and (4) fine- to medium-grained leucosome-granite which occurs in only one locality. The majority of the batholith underlying NTS map area 11D/15 consists of medium- to coarse-grained leucosome-granite and contains cordierite (trace-2%), in addition to biotite (average 6%) and trace amounts of muscovite. ‘Specialized’ leucosome-granite (or high ratio) bodies were outlined following the work of Ford (1991), who suggested that these rocks have an eU/eTh ratio greater than 1. These bodies were found to display variability in texture (porphyritic, pegmatitic, aplitic, equigranular) and mineralogy (abundances of muscovite, biotite).

Biotite-rich rocks (average 8% biotite) occur in three places along the southern Meguma Group metasedimentary/ granite contact and one area underlying the eastern edge of Tangier Grand Lake. All of these bodies have associated polymetamorphic mineral occurrences and all occur near contacts with the metasedimentary rocks. In the Tangier Grand Lake area, although not geographically adjacent to a visible contact, other geological phenomena (metasedimentary xenoliths and inclusions, biotite schlieren) suggest that this area is close to the roof zone of the batholith. Association of mineral occurrences with the more biotite-rich rocks is curious and will be discussed further in the final report.

References


