

**Compilation of geochemical and
petrographic data from the western and
southern parts of the Goldenville and
Halifax groups, Nova Scotia**

Open File Report ME 2010-1

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Natural Resources

Halifax, Nova Scotia
2010

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*Tables are available at <http://www.gov.ns.ca/natr/meb/pdf/10ofr01.asp>.

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Introduction

The focus of this report is the Goldenville and Halifax groups as exposed in the southwestern half of Meguma terrane where the distribution of formations is now well constrained by systematic regional mapping (White *et al.*, 1999, 2001; Horne *et al.*, 2000; White and King, 2002; White, 2003, 2005, 2006, 2007, 2008) (Fig. 1). The northeastern part of the terrane (Halifax-Canso area of Waldron *et al.*, 2009) is excluded because detailed stratigraphy has not yet been well defined in that area. The southwestern part of the Meguma terrane is divided into the following two parts by the Chebogue Point shear zone (Figs. 1 and 2): the Yarmouth to Digby area (herein termed the western area), and the Wedgeport to Chester area (herein termed the southern area). Stratigraphic units in the western area include the Church Point and Bloomfield formations (Goldenville Group) and the overlying Acacia Brook and Bear River formations (Halifax Group). Stratigraphic units in the southern area include the Moses Lake, Green Harbour, Government Point and Moshers Island formations (Goldenville Group) and the overlying Cunard and Feltzen formations (Halifax Group).

Geochemistry

A database for major and trace element chemical data from the Goldenville and Halifax groups was assembled from different sources (Tables 1a, b). The database contains information from approximately 650 whole-rock samples, representing both psammitic and pelitic rocks in all of the formations in the Goldenville and Halifax groups. Anomalous materials, such as quartz veins or mineralized areas, are excluded. Because the data were analyzed by different methods in different laboratories over a long period of time data quality varies, and different data sets contain somewhat different elements (especially trace elements). Some data sets do not include loss on ignition, or had already been retotalled to 100% volatile-free and original data are no longer available. The samples included in this report are considered to provide a reasonably representative chemical background for the Goldenville and Halifax groups.

Metasandstone Petrography

To document the mineralogy and investigate provenance, approximately 280 metasandstone and conglomerate samples were examined in thin section for this study (Tables 2, 3 and 4). These samples represent all of the defined stratigraphic units in both the Goldenville and Halifax groups (except the Moshers Island and Feltzen formations which lack psammitic beds coarse enough for modal analysis) and provide reasonable spatial coverage of the area. In most of these samples, the

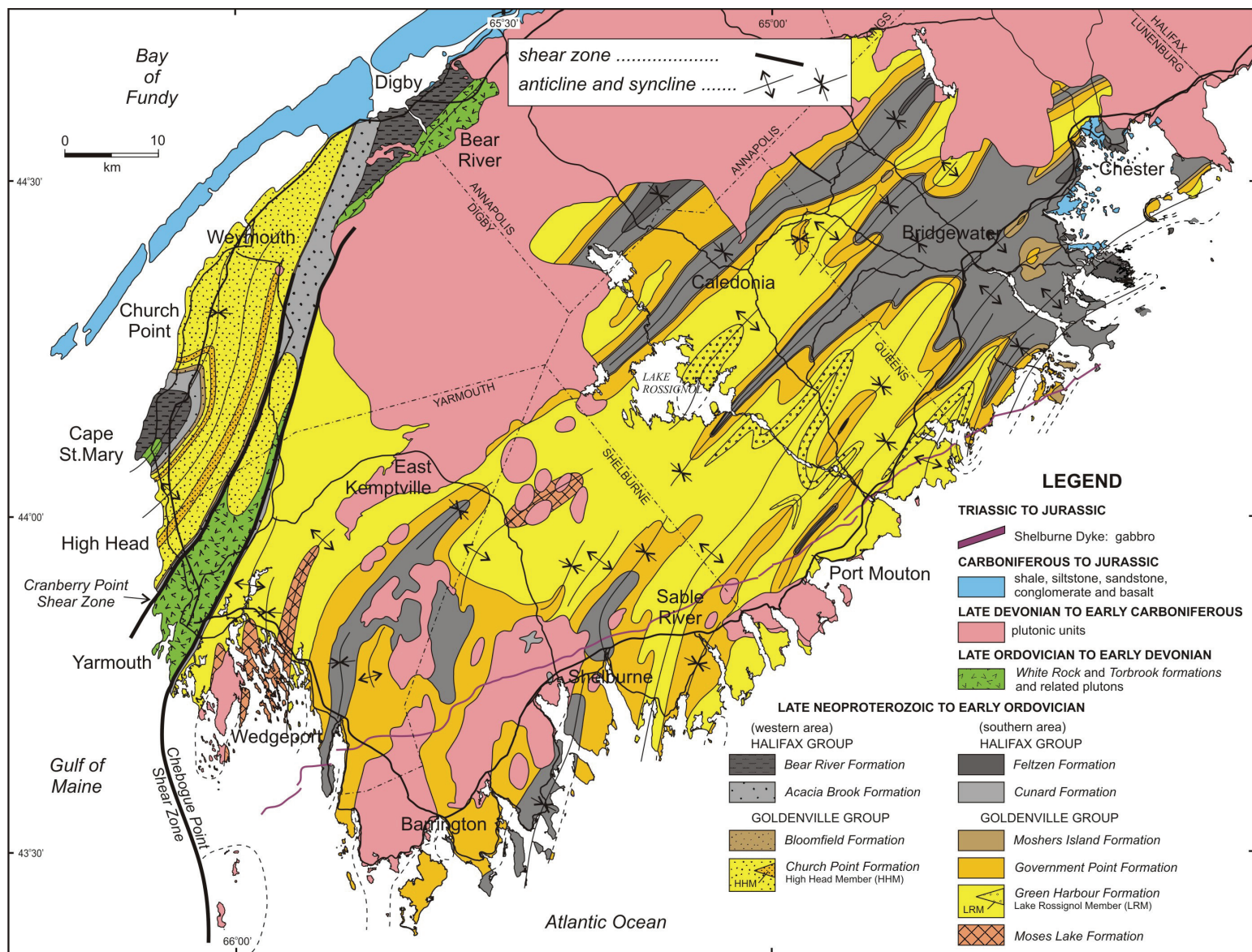


Figure 1. Geological map of the southwestern part of the Meguma terrane.

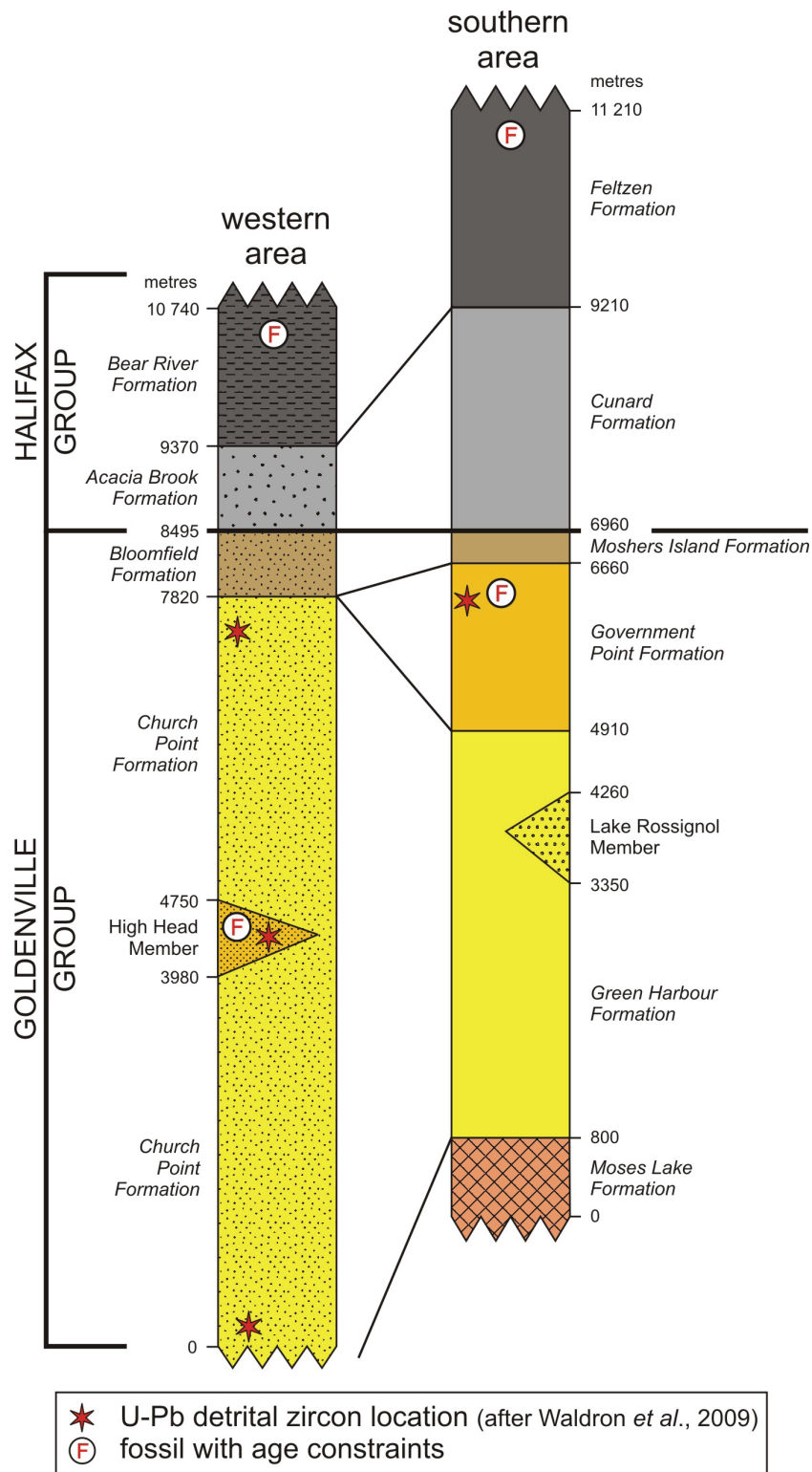


Figure 2. Stratigraphy in the western (west of the Chebogue Point shear zone) and southern (east of the Chebogue Point shear zone) areas of the southwestern part of the Meguma terrane.

original clay matrix has been recrystallized to a mixture of sericite, chlorite and epidote as a result of regional greenschist facies metamorphism, but individual sand-sized detrital grains are little affected. Modal analysis was possible even in those samples where regional or contact metamorphism was locally at higher grades. About 500-1000 points were counted in each thin section, using a modified version of the Gazzi-Dickinson method, which includes counting grains where they form part of a lithic fragment to eliminate apparent variations in the composition of samples resulting only from differences in grain size (Ingersoll *et al.*, 1984).

In all of the metasandstone samples quartz is the most abundant detrital component, with lesser amounts of feldspar and minor or no lithic fragments. A few samples have <5% matrix and are classified (using the system of Boggs, 2001) as feldspathic arenite to quartz arenite (Fig. 3a, b). Most samples have >5% matrix, however, and are classified as feldspathic wacke to quartz wacke (Fig. 3c-l). Overall, although they show a similar range, a higher proportion of samples from the western area are feldspathic wacke, whereas samples from the southern area include a higher proportion of quartz wacke. Most of the metasandstone samples from both areas have compositions indicative of derivation from a craton interior or transitional continental source using the criteria of Dickinson *et al.* (1983), indicated by the superimposed fields in Figure 3. A higher proportion of samples from the southern area, however, plot in the craton interior to transitional continental fields compared to samples from the western area, which plot mainly in the transitional continental field (Fig. 3).

Although psammitic rocks are relatively minor components in the mainly pelitic Halifax Group compared to the Goldenville Group, no significant change was noted in metasandstone modal composition with stratigraphic position (Fig. 3), indicating that no significant change occurred in provenance during the time when this thick succession was being deposited, other than an increasing abundance of fine-grained sediment.

Looking in more detail at the clast components, most feldspar grains are subrounded to rarely euhedral plagioclase (with or without twinning) and are partially altered to sericite, epidote or calcite. Myrmekitic texture is locally present. Plagioclase composition is typically albitic (Toole, 2006), consistent with regional greenschist facies metamorphism. Plagioclase with higher An contents (up to An₅₀) is restricted to higher grade contact metamorphic aureoles around plutons (Mahoney, 1996; White, 2003). Potassium feldspar is present rarely, and displays crosshatch twinning indicative of microcline. Detrital muscovite is present in many samples and ranges in abundance up to 4%, but detrital biotite was observed in only a few samples. Trace amounts of zircon, titanite, tourmaline and opaque minerals also occur.

The scarcity of alkali feldspar and abundance of less chemically stable plagioclase suggests that the source area lacked alkali feldspar, rather than that the source area was exposed to prolonged weathering (e.g., Ingersoll and Suczek, 1979). The mineralogy also suggests rapid uplift and erosion in the source area and that the sediment was not multicyclic and was buried quickly. Given their turbiditic characteristics (Schenk, 1997), the sediments probably were shed from a rifted continental margin and transported through submarine canyons to accumulate on the continental rise.

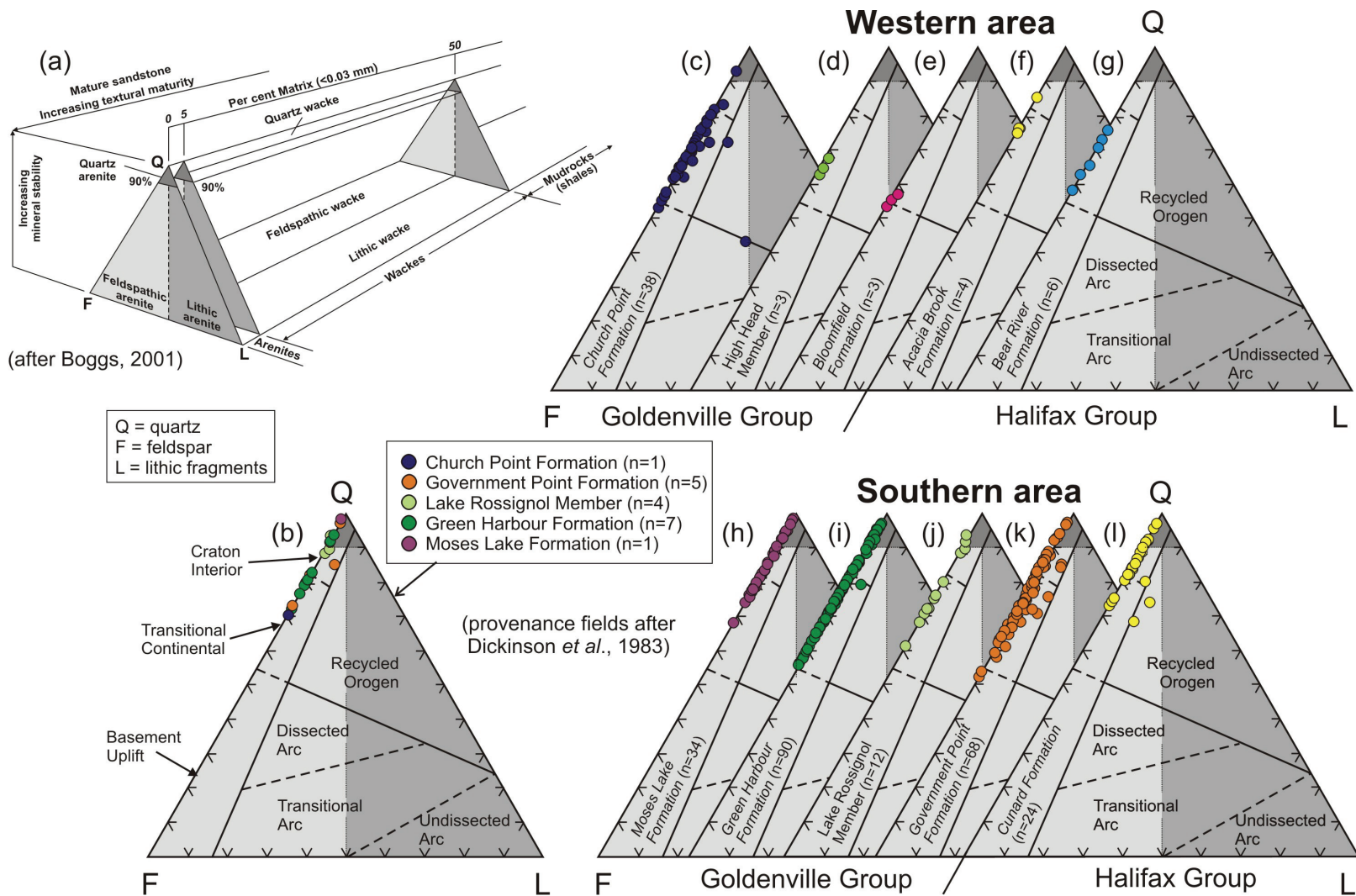


Figure 3. (a) Classification of sandstone based on modal quartz (Q), feldspar (F), lithic fragments (L) and proportion of matrix. (b) Classification and provenance for samples from the Goldenville and Halifax groups with <math><5\%</math> matrix. (c) to (l) Classification and provenance for samples with >5% and <math><50\%</math> matrix. Shaded classification fields from (a) are shown on (b) to (l).

Lithic fragments are rare in the metasandstone samples, but 43 metaconglomerate samples from the Church Point, Green Harbour (Lake Rossignol Member) and Government Point formations were also examined to identify clast lithology (Fig. 4). Lithic clasts in both metasandstone and metaconglomerate samples are mostly quartzite, and include unfoliated, foliated and mylonitic varieties. Felsic and mafic volcanic clasts are present in metaconglomerate and some metasandstone samples from the Church Point Formation, whereas igneous clasts from the Lake Rossignol Member and Government Point Formation are mainly tonalite or, rarely, granite. Sedimentary clasts are rare in all these units and, where present, are probably intraformational in origin, based on their pelitic compositions. Most of the samples plot in the rifted continental margin field (Fig. 4a, b), consistent with the interpretation based on metasandstone samples in Figure 3.

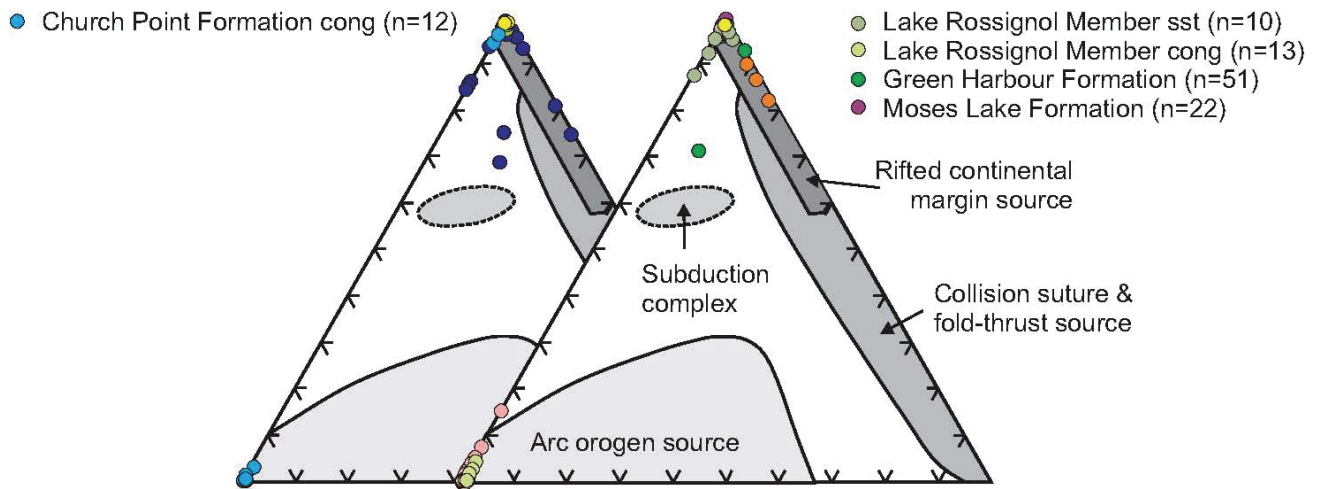


Figure 4. Composition of lithic fragments in conglomerate samples and in psammitic samples that contain them.

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