DIGITAL BEDROCK GEOLOGY DATASET: ONLINE

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ABSTRACT

The Digital Bedrock Geology dataset is the principal repository for geological information on the province's bedrock geology. It comprises geological information on 2900 legend entries, represented by 13 342 spatially defined units from 150 maps and figures of insular Newfoundland.

The most recent published bedrock geology maps for insular Newfoundland have been digitized at their full levels of detail. Data are organized into polygon and line files with attributes containing map-unit information.

*The Digital Bedrock Geology compilation has consistent unit labelling and legend schemes. This data can be displayed and downloaded (extracted), as ArcGIS shape files, through the online Geoscience Resource Atlas on the Geological Survey's GeoScience Online website (*http://www.gov.nl.ca/mines&en/geosurvey*). The user has the option of specifying the geological level of detail (*i.e.*, detailed, generalized, lithofacies or 1:1-million scale contacts and polygons), the extent of the coverage and the individual data (*e.g.*, contacts, faults, geology polygons) to display, query or download. The selected files available for download contain from 6 to 76 fields of attribute information.*

As of November 2008, full map-unit data had been compiled for about 80 percent of insular Newfoundland. Preliminary digitizing has been completed for the remainder of the Island, and most of Labrador. The future directions of the project include completing map-unit coverage and updating online accessibility.

INTRODUCTION

A digital bedrock geology database is being prepared from the most recently published maps for Newfoundland and Labrador. A list of recently published geology maps of Newfoundland and Labrador, grouped by National Topographic System (NTS) area, is available through the *Geological maps* section of the Geological Survey's website. The source maps range in scale from 1:10 000 to 1:250 000, but are predominantly 1:50 000. Aside from geological unit polygons, lines (*i.e.*, map-unit contacts, faults, regional structural trends and isograds) have also been geospatially captured from original published maps. Unit labels and legends are standardized for all maps using *GeoLegend* (Colman-Sadd *et al.*, 1996).

For digital provincial coverage, the *1 Million Bedrock Geology (Lithofacies)* data layer is recommended. The geospatial bedrock polygon and associated line file, *1 Million Faults & Contacts*, were created from two previously published maps (Colman-Sadd *et al.*, 2000; Wardle *et al.*, 1997). These layers serve as a regional background base-map to other line and point-data layers available through the

Geoscience Resource Atlas. Also, they are the basis for the *Lithology* version of the *Partial Bedrock Geology Dataset* for the Island of Newfoundland (Colman-Sadd and Crisby-Whittle, 2005).

Online users are directed to use the various data layers, with the *(NFLD2616 v.6)* suffix, for more detailed information than is available from, *1 Million ...* layers. Note that coverage for the eastern portion of Newfoundland is presently not available.

ORGANIZATION

Published maps have been scanned from their original printed form and then re-created as a digital file having a standardized legend, for entry into the integrated map, which incorporates the most recent geology for the Island. Every individual unit that was shown on the original map is maintained in the compilation, regardless of the scale of the original map. Original map-unit boundaries remain intact but the unit labels are changed to accommodate production of one standard legend, province-wide. To date, there are 2900 distinct legend descriptors ranging from the highest

'Supergroup' hierarchy down to the most detailed 'sub4-unit' in the detailed stratigraphy legend or from the most specific 'tectonic assemblage' to the most generalized 'rock classification' in the tectonic assemblage legend theme.

All themes of the Bedrock Geology Dataset (NFLD2616 v.6), whether it be detailed, generalized, lithofacies or tectonic, are created from the same geospatial data file. Each individual polygon (13 342 in total) is tied to a record in the database containing 76 attribute fields. There are four levels of geological detail that can be accessed through these fields. These are distinguished in the database by the prefixes D_, G_, L_ and A_ in the field name (column header). Field names beginning with D_ provide information on 'Detailed Stratigraphy'. Similarly, G_ describes 'Generalized Stratigraphy', L_ describes 'Lithofacies' information, and A_ describes 'Tectonic Assemblage'. The original label is also maintained in this database.

Along with the standardized descriptions of each geological unit, the original legend text is being captured and will be added to the database so that legacy data will be accessible and searchable. It is conceivable that the effectiveness of a search for a specific rock type may be hindered by not having kept the author's verbatim description of a unit from the original map legend. There are times when it might prove useful, for instance, to use a now abandoned term to isolate a specific mineral-hosting rock type. The user is advised though, to first perform a keyword or stratigraphic name search on the fields of the database containing the standardized legend names. The standardized legend created from '*GeoLegend*' (Colman-Sadd, 2003) is based on a wealth of knowledge and current geological interpretations. Three of the '*GeoLegend'* derived legend classifications of the data are available for viewing in the Geoscience Resource Atlas, accessible through the Geological Survey's *GeoScience OnLine* webpage.

Regional structural information has been captured and maintained for each individual map as well as combined into an integrated *Structural Trend* file. This file can be used in conjunction with the main geology polygon file. Efforts are continuing to make this data more informative, at preset scales. As with all other data captured from previously published maps, the highest level of detail is maintained. However, the representation of these features through the standard practice of line ornamentation is limited in the online viewing environment. Just as different legend representations of the bedrock geology are appropriate for different scales, so is the case for structural trend data. For obvious reasons, symbolized lines that can be seen when zoomed in cannot be depicted the same way when zoomed out to much smaller scale coverage. Therefore, a series of scale-dependent line symbolization files is being developed for display in ArcGIS and download.

ACCESSING BEDROCK GEOLOGY DATA

From the *GeoScience OnLine* (*http://gis.geosurv.gov. nl.ca/*) webpage (Figure 1), click the *Geoscience Resource Atlas Interactive Maps of Geology, Geophysics, Geochemistry, Mineral Occurrences, Claims, Drill Core Reports, Maps and more* to open the *Geoscience Resource Atlas* viewer.

To display the geology map (Figure 2) click on the *Bedrock Geology* check box toward the bottom of the legend list. To select a different level of geological detail, click on the blue box beside *Bedrock Geology* and select the appropriate options (Figure 3), including faults, water lines and polygons.

The complete coverage of the province is only available at a compilation scale of 1:1 million. This layer was created from a separate map for each of the Island portion of Newfoundland (Colman-Sadd *et al.*, 1990), and Labrador (Wardle *et al.*, 1997). The attribute data for this geospatial map is limited to eight fields, only four of which contain geological attributes (Figure 4): geological unit label, age, tectonic province and lithological descriptors. The *1 Million* layers will not be discussed further.

A full legend description for the Labrador map is available in .pdf format from the *Geological Maps* section of the Survey's webpage. A similar .pdf of the Newfoundland map legend is available through various sources, including the following website, (*http://10.50.152.160/ResourceAtlas/ help/Bedrock_Geology/Newfoundland Legend.pdf*) and the help files in the *Bedrock Geology Dataset - NFLD 2616 v. 6 – User Guide* (*http://10.50.152.160/ResourceAtlas/help /Bedrock_Geology/OF2616v6 USER GUIDE.pdf*) .

To date, 150 maps have been incorporated into the *Bedrock Geology Dataset*, providing coverage of the Humber, Dunnage, and Gander tectonic zones. Maps from the Avalon tectonic zone are being processed and have yet to be added to the integrated map. For bedrock geology west of the Avalon tectonic zone, one of the three *Detailed* (Figure 5), *Generalized* (Figure 6) or *Lithofacies* (Figure 7) map themes should be used as the bedrock base to the other map layers.

Help files that were included in the documentation with the CD-ROM release of the *Bedrock Geology Dataset* (Colman-Sadd and Crisby-Whittle, 2005) have been updated and are available in the *Bedrock Geology* section of the *Geoscience Resource Atlas*. The web adaptation of the *Bedrock Geology Dataset - NFLD 2616v.6 User Guide* is provided along with Legend text to accompany the *Detailed Stratigraphy, Generalized Stratigraphy, Lithofacies* and *Tectonic*

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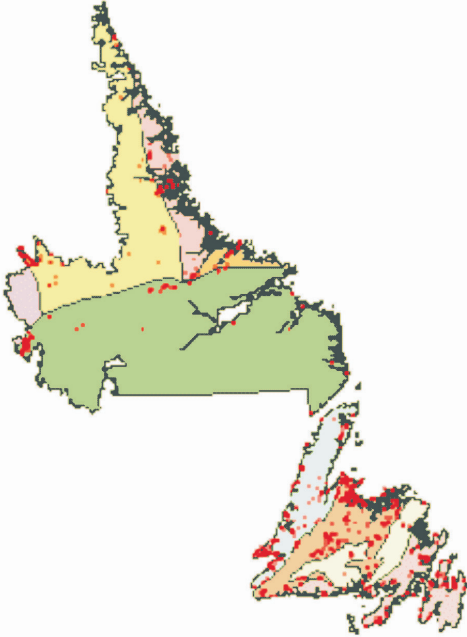# GeoScience OnLine - What's New

Geoscience Resource Atlas

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| Mineral Rights Inquiry Form |
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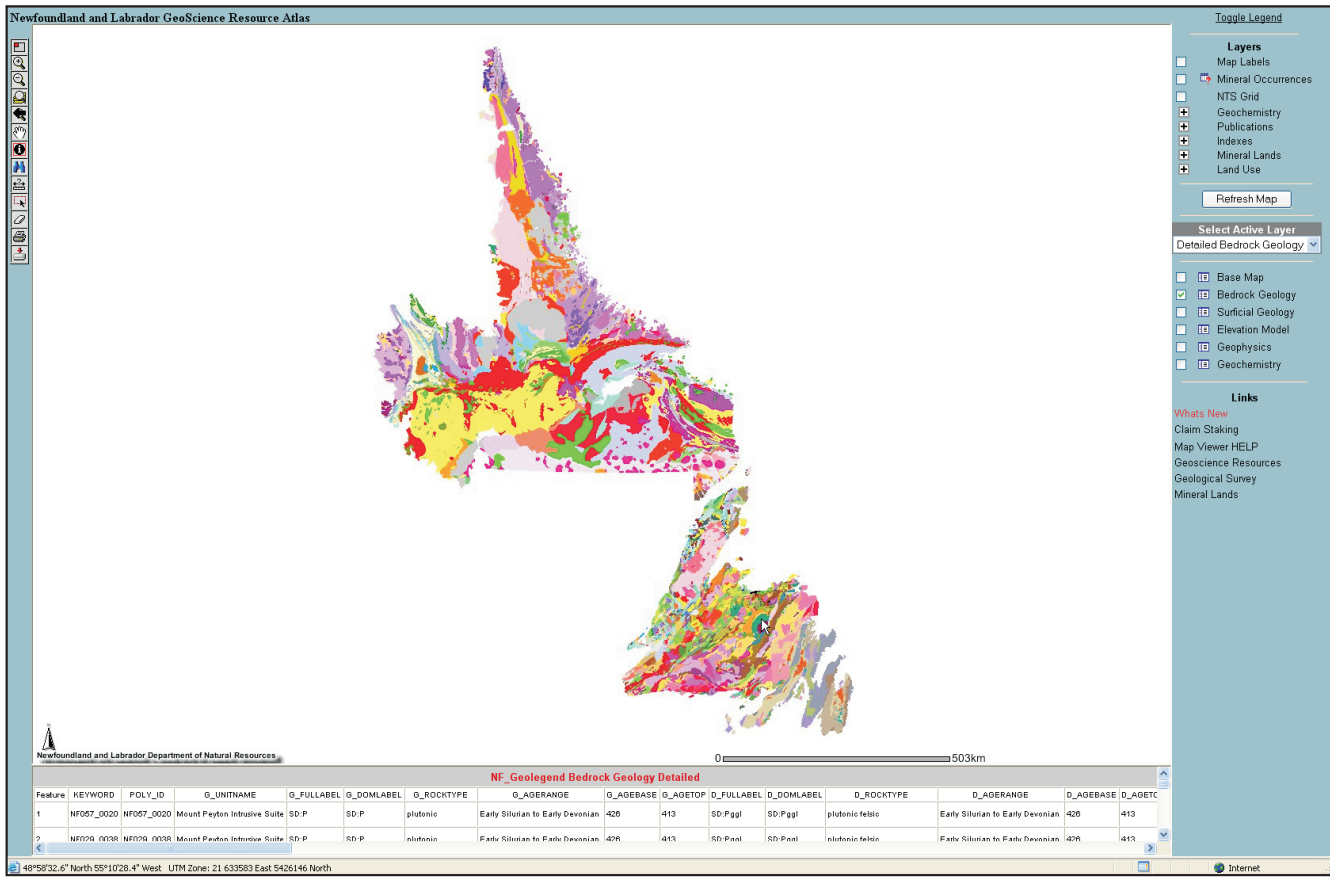**Figure 1.** *Geoscience online web page.*

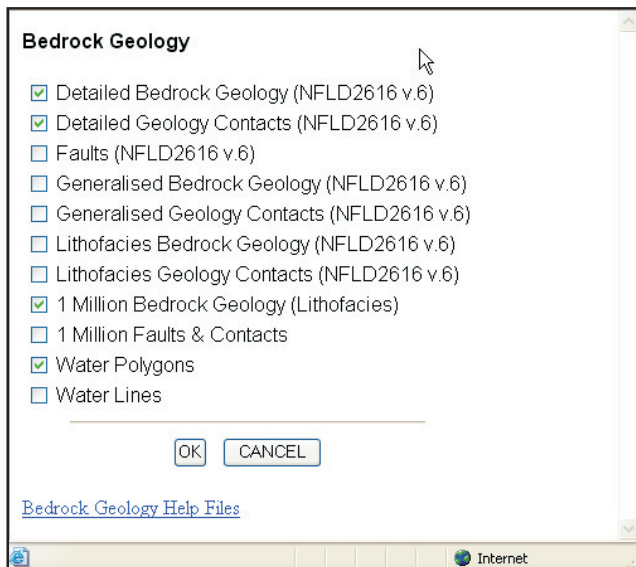**Figure 2.** *Geoscience Resource Atlas viewer.*

Figure 3. *Bedrock geology options.*

Assemblage themes. Complete descriptions of attributes included in the *Polygon, Line* and *Fault* files along with a *Summary rock type* listing, *Geologic Time Scale* and *Reference list* are all accessed through the help file.

For a complete list of attributes contained in the *Digital Bedrock Geology Dataset* NFLD/2616v6 (Colman-Sadd and Crisby-Whittle, 2005) and their descriptions, the reader should refer to Appendices 1 and 2, for the line and polygon descriptions, respectively.

LEGACY DATA

With the proliferation of electronic data transfer and Geographical Information System (GIS) usage, more and more clients require geology maps in digital format. During the process of creating a GIS product, paper maps are scanned, rectified to a geographic projection, and then digitized to create polygon, line and point files to which much attribute data is attached. The images of many of the original geology maps are now saved in .pdf format and made available for viewing and downloading from the Geological Survey's website. To date, there are 75 maps for Newfoundland and 80 for Labrador in .pdf format. These maps are grouped according to NTS area and are available from the *Geological Survey's website*, directly through the *Geological Maps* link or through various other links (*e.g.*, *Publications & Reports, GeoScience Online*) to the *Index of Bedrock Geology maps* for the Island (Figure 8). To deter-

1 Million Bedrock Geology							
Featur	LAB	AGE	TECTONIC	LITHOLOGY	REFERENCE	AREA	LEN
1	SDg	Silurian to	Late	granitoid suites	Colman-Sadd et al.	0.054755139	1.1862093220

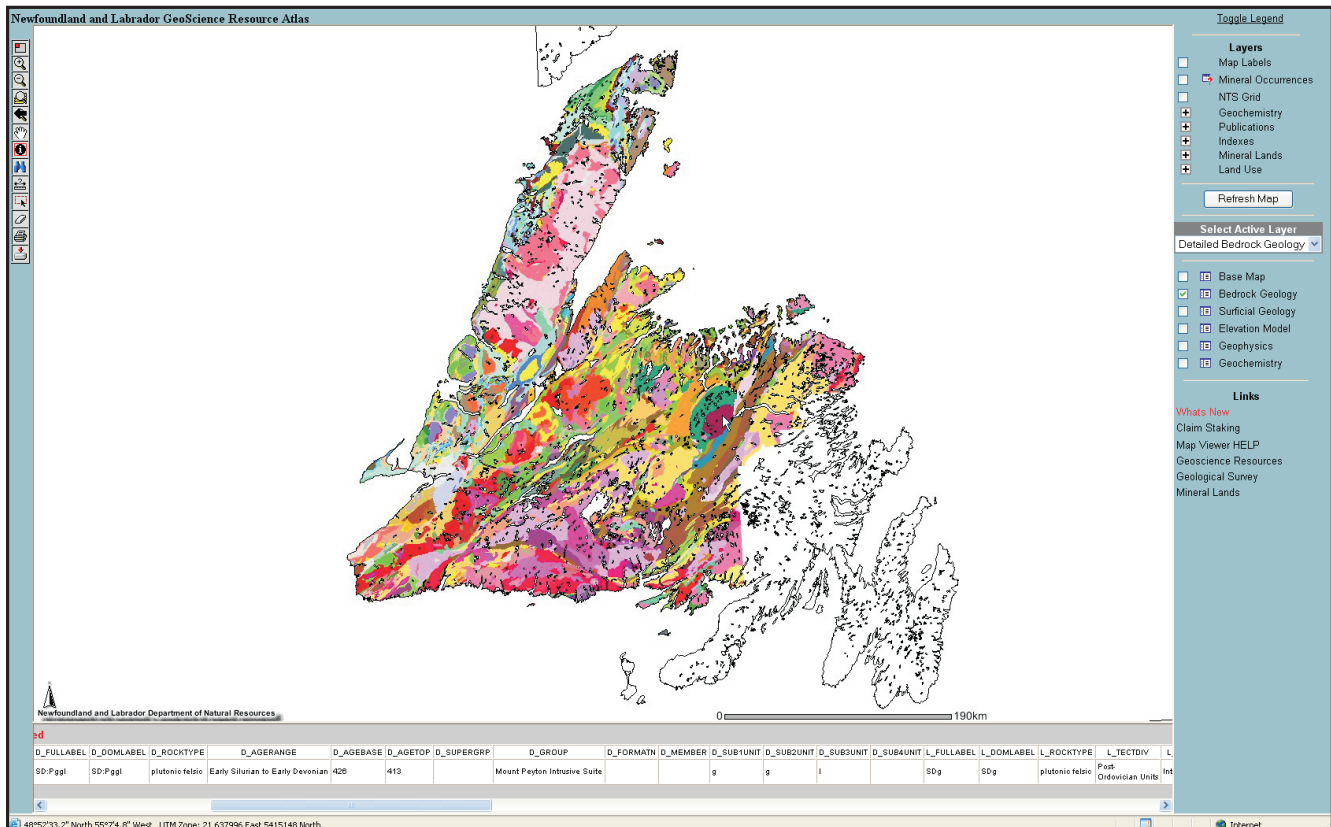**Figure 4.** *1:1-million data fields.*

Figure 5. *Detailed stratigraphy.*

mine if a map is available in .pdf format, click on an NTS sheet. If a map reference contains a 'Preview Map' hyperlink then it is available for viewing and saving. The Index will be updated on a continual basis.

Currently, 60 bedrock geology maps of Labrador are also available on request as spatially registered tagged image file format geo(tiff) files. Many of these maps have been digitized and preliminary vector data are also available on request.

FUTURE DIRECTIONS

For the Island portion of the province, the integration of published maps will continue until full coverage of the Island has been achieved. Legacy legend descriptions will be added to the bedrock geology database.

A corresponding database will be prepared with the most recent published bedrock geology maps of Labrador. Labrador maps will also be processed through the GeoLegend method of interpreting and re-labelling geological units based on a standardized legend.

Work will continue until coverage of legacy maps, available for download (.pdf.) from the Geological Survey website, is complete. Consideration is also being given to making available, though the *Geoscience Resource Atlas*, the registered bedrock geology geo(tiff) files.

Online data content and query, viewing and download capabilities of the Bedrock Geology will continue to be improved upon.
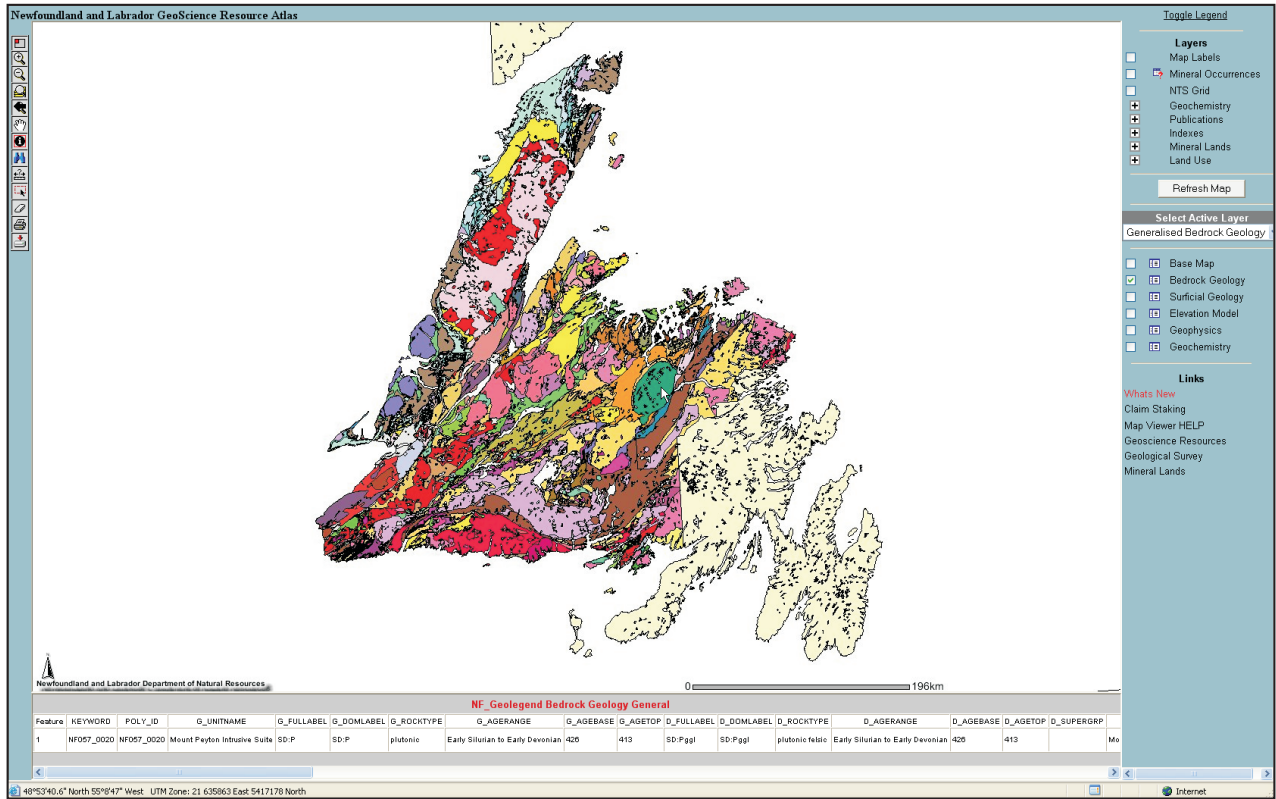
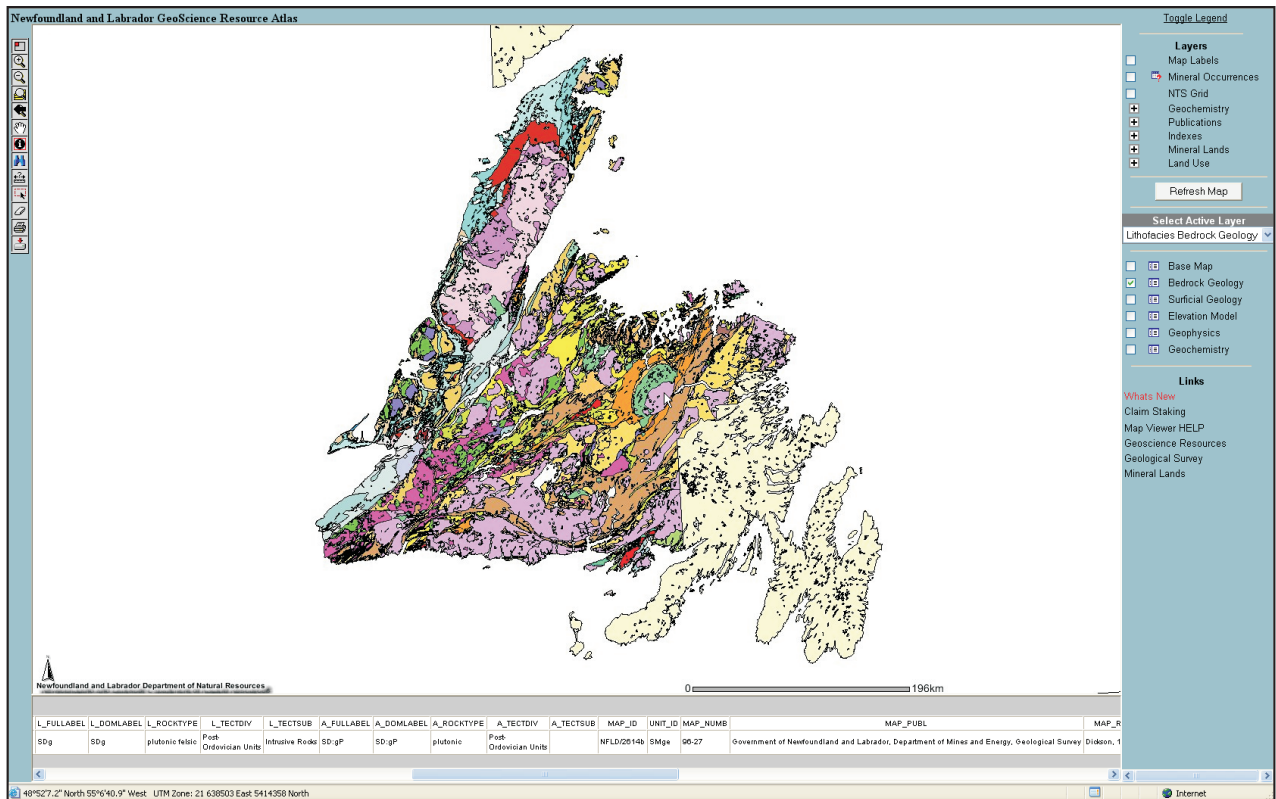**Figure 6.** *Generalized stratigraphy for central and western Newfoundland.*

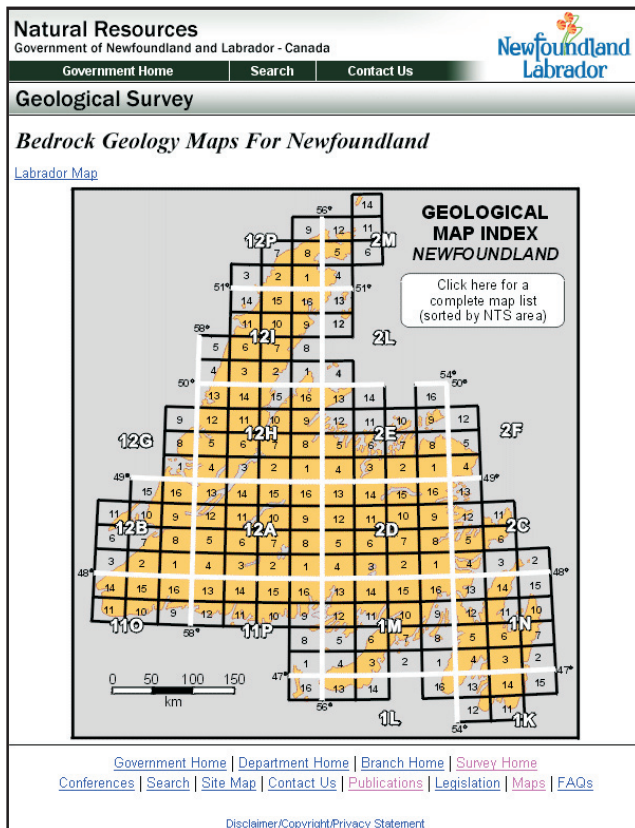**Figure 7.** *Lithofacies for central and western Newfoundland.*

Figure 8. *Geological map index.*

ACKNOWLEDGMENTS

Capable digital capture and GIS skills were provided by Tony Paltanavage, Jacob Prince and Gillian Simms. Joanne Rooney and Bev Strickland are thanked for their help in capturing and posting historical map text and images. Larry Nolan and Andrea Bassan have been major contributors to the development of the database model. Each of the map authors, whose work has been incorporated into the Digital Geology Database, is thanked for their consultation and support of the project. The work of Steve Colman-Sadd, John Hayes and Steve Ash with their foresight and diligence has served to provide a solid foundation to this project. A scientific review of this report by Pauline Honarvar is greatly appreciated.

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Colman-Sadd, S.P., Hayes, J.P. and Knight, I. (compilers)
    1990: Geology of the Island of Newfoundland. Map 90-01. Scale: 1:1 000 000. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey Branch, Open File GS# NFLD/2192.

    2000: Geology of the Island of Newfoundland (digital version of Map 90-01 with minor revisions). Map 2000-03. Scale: 1:1 000 000. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey Branch, Open File GS# NFLD/2192

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Williams, H., Colman-Sadd, S.P. and Swinden, H.S.
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APPENDIX 1

Line Attributes
Contained in the Digital Bedrock Geology
(Adapted from Open File NFLD/2616 v6.0)

GEOLOGICAL CONTACT ATTRIBUTE TABLES
Geological contact shapefiles [xxx_contacts.shp]:
The geological contact attribute table contains one record for each polyline segment that defines polygon outlines. Most of these lines represent contacts between units but some represent the boundaries between source maps. The four versions of the contact files (*e.g.*, NF_Geolegend_Detailed_Contacts) have been derived from a master file by deleting lines between polygons that contain the same full legend label (FULLABEL). They provide edited lines appropriate to different views of the map. For the detailed map, the deleted lines are principal boundaries between source maps. The generalized, lithofacies and tectonic assemblage maps include contacts between subdivisions of lumped units.

OVERVIEW OF FIELDS
Each record in the contact line file is linked to ten fields of information in an attribute table. The GIS software generates some of these fields, such as the Feature reference number, Shape_Leng, Area and Len, which contain non-geological data. The left and right polygon labels have been used to compare the units on each side of a line and generate the appropriate line work for the map at each level of detail.

Each record in the contact files has the following fields (not ordered as shown):

Line Characteristics	*Field Name*
Reference number	Feature
Contact feature code	FEATURE
Original map source	SOURCE_ID
Length of the line in metres	SHAPE_LENG
Area of the line (0 for lines)	AREA
Length of the line in metres	LEN
Adjacent polygons	
Unique polygon identifier to the left of the line	LEFT_POLY
Unique polygon identifier to the right of the line	RIGHT_POLY
Full legend label for the left polygon	X_FULLAB_L
Full legend label for the right polygon	X_FULLAB_R

The value for X is either D, G, L or A depending on whether the set of lines being viewed, are related to the Detailed, Generalized, Lithofacies or Tectonic Assemblage theme of the bedrock map. It is emphasized that the line work for all four versions of the map is the same, except that, depending on the theme, lines have been deleted between polygons with the same legend label at the given level of detail.

The possible feature codes in the "FEATURE" column for the contact lines are as follows:
Contact (unspecified)
Contact; gradational or transitional
Contact; assumed
Contact; approximate
Contact; defined
Contact, geophysical
Unconformity, assumed
Unconformity, approximate
Unconformity, defined
Unconformity
Limit of mapping

Topography close (Dummy line to close off polygons at the coastline)
Geology close (Dummy line to close off polygons under lakes and where polygons were left open-ended on the source map)
NTS, computer generated (Computer generated NTS area boundary)
Neatline, original source (NTS area boundary on the source map)

GEOLOGICAL FAULTS
Fault shapefile [faults.shp]:
The fault attribute table contains one record for each polyline segment of a fault (fold axes are also included in a few areas). Fault files do not vary in the level of detail. Where these faults also form contacts between different geological units they are represented in the contact shapefile by the feature code "Topography Close" or "Geology Close".

Each record in the fault file has the following six fields:

Line characteristics	*Field Name*
Reference number	Feature
Length of the line in metres	SHAPE_LENG
Fault feature code	FEATURE
Original map source	SOURCE_ID
Area of Feature (0 for lines)	AREA
Length of the line in metres	LEN

The possible feature codes in the "FEATURE" column for the fault lines are as follows:
Fault
Fault or major strain zone
Fault, approximate
Fault, assumed
Fault, defined
Fault, high angle, approximate
Fault, high angle, assumed
Fault, high angle, defined
Fault, high angle, dip direction known, approximate
Fault, high angle, dip direction known, assumed
Normal (solid circle on downthrow side)
Strike-slip, dextral, approximate
Strike-slip, dextral, defined
Strike-slip, sinistral, assumed
Strike-slip, sinistral, defined
Thrust (teeth on the upthrust side)
Thrust, 2nd generation, approximate
Thrust, 2nd generation, defined
Thrust, approximate (teeth on the upthrust side)
Thrust, assumed (teeth on the upthrust side)
Thrust, defined (teeth on the upthrust side)
Thrust, overturned, approximate

APPENDIX 2

Polygon Attributes
Contained in the Digital Bedrock Geology
(Adapted from Open File NFLD/2616 v6.0)

Geological polygon shapefiles [xxx_Geology.shp]:
The geology polygons are the unit areas digitized from the source maps. he attribute table contains one record for each unique polygon. Every individual unit that was shown on the original map is maintained in the compilation, regardless of the scale of the original map. If the same unit is mapped across two adjacent source maps they will be represented in the database by two records with unique identifiers but with the same geological information. The four versions of the geology polygon files (*e.g.*, NF_Geolegend_Bedrock_Geology_Detailed) have been derived from a master file by deleting lines between polygons that contain the same full legend label (FULLABEL). They provide edited polygons appropriate to different views of the map.

OVERVIEW OF FIELDS
Each record in the polygon file is linked to 64 fields of significance to the general user. The GIS software generates additional fields, such as the Feature reference number, Shape_Leng, Area and Len, which contain non-geological data.

Each record in the polygon files has the following significant fields (not including the GIS generated fields):

Polygon Abbreviated Name
1. Polygon identifier POLY_ID

Generalized Geology Fields
2. Unit name (generalized) G_UNITNAME
3. Full label (generalized) G_FULLABEL
4. Dominant label (generalized) G_DOMLABEL
5. Summary rock type (generalized) G_ROCKTYPE
6. Age range of unit (generalized) G_AGERANGE
7. Age of base of unit (generalized) G_AGEBASE
8. Age of top of unit (generalized) G_AGETOP

Detailed Geology Fields
9. Full label (detailed) D_FULLABEL
10. Dominant label (detailed) D_DOMLABEL
11. Summary rock type (detailed) D_ROCKTYPE
12. Age range of unit (detailed) D_AGERANGE
13. Age of base of unit (detailed) D_AGEBASE
14. Age of top of unit (detailed) D_AGETOP
15. Supergroup D_SUPERGRP
16. Group D_GROUP
17. Formation D_FORMATN
18. Member D_MEMBER
19. Sub1-unit D_SUB1UNIT
20. Sub2-unit D_SUB2UNIT
21. Sub3-unit D_SUB3UNIT
22. Sub4-unit D_SUB4UNIT

Lithofacies Fields
23. Full label (lithofacies) L_FULLABEL
24. Dominant label (lithofacies) L_DOMLABEL
25. Summary rock type (lithofacies) L_ROCKTYPE
26. Tectonic division (lithofacies) L_TECTDIV
27. Tectonic subdivision (lithofacies) L_TECTSUB

Tectonic Assemblage Fields
28. Full label (tectonic assemblage) A_FULLABEL
29. Dominant label (tectonic assemblage) A_DOMLABEL
30. Summary rock type (tectonic assemblage) A_ROCKTYPE
31. Tectonic division (tectonic assemblage) A_TECTDIV
32. Tectonic subdivision (tectonic assemblage) A_TECTSUB

Source Map Fields
33. Map ID MAP_ID
34. Unit ID UNIT_ID
35. Map number MAP_NUMB
36. Publisher MAP_PUBL
37. Map reference MAP_REF
38. Map scale MAP_SCALE

Ordering Number Fields
39. Generalized unit ordering number ON_G_LABEL
40. Detailed unit ordering number ON_D_LABEL
41. Lithofacies unit ordering number ON_L_LABEL
42. Lithofacies tectonic subdivision ordering number ON_L_ZONE
43. Tectonic assemblage ordering number ON_A_LABEL
44. Tectonic assemblage tect. subdiv. ordering number ON_A_ZONE

Colour Fields
45. Red (generalized) G_RED
46. Green (generalized) G_GREEN
47. Blue (generalized) G_BLUE
48. RGB quad (generalized) G_RGBQUAD
49. Red (detailed) D_RED
50. Green (detailed) D_GREEN
51. Blue (detailed) D_BLUE
52. RGB quad (detailed) D_RGBQUAD
53. Red (lithofacies) L_RED
54. Green (lithofacies) L_GREEN
55. Blue (lithofacies) L_BLUE
56. RGB quad (lithofacies) L_RGBQUAD
57. Red (tectonic assemblage) A_RED
58. Green (tectonic assemblage) A_GREEN
59. Blue (tectonic assemblage) A_BLUE
60. RGB quad (tectonic assemblage) A_RGBQUAD
61. RGB quad as text (detailed) D_RGBText
62. RGB quad as text (generalized) G_RGBText
63. RGB quad as text (tectonic assemblage) A_RGBText
64. RGB quad as text (lithofacies) L_RGBText

DETAILED EXPLANATION OF FIELDS
[Note: the various .pdf files referred to below are hyperlinked to the source file or can be viewed through the Online Resource Atlas by clicking on the Bedrock Geology theme properties, then Bedrock Geology Help Files, and then the specific item.]

Polygon
1. Polygon identifier [POLY_ID]:
This is the identifier attached to each map polygon. Identifiers have the form NFxxx_yyyy, where xxx is a number representing the source map from which the polygon was digitized, and yyyy is a number from 001 to 1999 representing a particular polygon within a map.

Generalized Geology Fields

Seven variables provide names, labels and ages of units for a generalized version of the map, subdivided at the highest level of the stratigraphic hierarchy, usually by Supergroup, Group or Formation. This level of subdivision corresponds to the legend provided in Generalized_Legend.pdf.

2. Unit name (generalized) [G_UNITNAME]:

The field contains the name of the highest ranking stratigraphic division to which the polygon belongs (*e.g.*, "Springdale Group"). The field is the same as the first of Supergroup, Group or Formation to have an entry in the more detailed classification (*see* fields 15 to 17). An unnamed unit is represented by its unit label, **Dominant label (generalized)**.

3 and 4. Unit labels (generalized) [G_FULLABEL, G_DOMLABEL]:

Labels are composed of one or two characters indicating the age of a unit, separated by a colon from one or two characters representing the stratigraphic division to which the unit belongs (*e.g.*, "eS:S" stands for "early (e) Silurian (S) Springdale Group (S)"). Labels are listed on the Generalized Legend with descriptions of the units.

Most polygons on a geological map have a simple label, indicating a single unit within the polygon; for these polygons the **Full label (generalized)** and the **Dominant label (generalized)** are the same. However, some polygons have complex labels that list two or more unseparated units. For these polygons, the dominant unit is usually the most important unit in the polygon (*e.g.*, "eS:S") and is used to determine the colour of the polygon; its unit label is in field 4. The full label, in field 3, shows the complete list of unseparated units (*e.g.*, "eS:S/eS:T").

IMPORTANT: Secondary units are included in the legend but the various polygon attributes, including unit names, age values and summary rock type, refer only to the dominant unit.

5. Summary rock type (generalized) [G_ROCKTYPE]:

The entry comes from the standard rock types listed in **Rock_Types.pdf**. The field contains the phrase that most accurately describes the lithology of the stratigraphic division in **Unit name (generalized)**. Descriptions are structured with the most general term first, followed by more specific terms (*e.g.*, "volcanic felsic marine"); this allows searches at various levels of lithological detail.

6. Age range of unit (generalized) [G_AGERANGE]:

The field provides the age range of the stratigraphic division in **Unit name (generalized)** in terms of eons and eras in the Archean, eras and periods in the Proterozoic, periods and subperiods in the Paleozoic and Mesozoic, and periods and epochs in the Cenozoic. The range is based on the numerical values for the ages of the base and top of the generalized unit (fields 7 and 8), and the values in **Time_Scale.pdf**.

7. Age of base of unit (generalized) [G_AGEBASE]:

This is the oldest age, expressed in millions of years that might reasonably be assigned to the base of the stratigraphic division in **Unit name (generalized)**. It may be derived from either radiometric or paleontological dating. Radiometric dates are adjusted for errors and paleontological dates are converted to absolute ages using the values in **Time_Scale.pdf**.

8. Age of top of unit (generalized) [G_AGETOP]:

This is the youngest age that might reasonably be assigned to the top of the stratigraphic division in **Unit name (generalized)**.

Detailed Geology Fields

Fourteen variables provide names, labels, rock types and ages of units for displaying a detailed version of the map. This is the same level of detail as is shown on the source maps from which the line work was digitized; most of these maps were produced at the 1:50 000 scale. This level of subdivision corresponds to the legend provided in **Detailed_Legend.pdf**.

9 and 10. Unit labels (detailed) [D_FULLABEL, D_DOMLABEL]:

As for generalized units, field 9 shows the full label and field 10 shows the label for just the dominant unit. The first one or two characters indicate the age of the unit and the succeeding characters represent the stratigraphic divisions of the unit in descending order (*e.g.*, "eS:Svf" stands for "early (e) Silurian (S) Springdale Group (S) volcanic (v) felsic (f)").

Note that the generalized and detailed labels are consistent. The characters indicating age are only different if the detailed sub-division has a more restricted age range than the generalized division. The character indicating the top rank unit is always the same and the characters indicating lower rank subdivisions are simply omitted from the generalized label.

11. Summary rock type (detailed) [D_ROCKTYPE]:
The entry comes from the standard rock types listed in **Rock_Types.pdf**. The field contains the phrase that most accurately describes the lithology of the dominant detailed unit in a polygon. Note that the description is of a unit, not of a particular polygon, so it may not be accurate for some polygons.

12. Age range of unit (detailed) [D_AGERANGE]:
The field provides the age range of the detailed unit in terms of eons and eras in the Archean, eras and periods in the Proterozoic, periods and subperiods in the Paleozoic and Mesozoic, and periods and epochs in the Cenozoic. The range is based on the numerical values for the ages of the base and top of the detailed unit (fields 13 and 14) and the values in **Time_Scale.pdf**.

13. Age of base of unit (detailed) [D_AGEBASE]:
This is the oldest age, expressed in millions of years that might reasonably be assigned to the base of the detailed unit. In most cases, a junior unit is not dated directly and what is actually shown is the age of a more senior unit to which it belongs.

14. Age of top of unit (detailed) [D_AGETOP]:
This is the youngest age that might reasonably be assigned to the top of the detailed unit.

15 to 18. Supergroup, Group, Formation, Member
[D_SUPERGRP, D_GROUP, D_FORMATN, D_MEMBER]:
These four fields give the names of the stratigraphic divisions to which a unit belongs. Both formal and informal names are used.

Note that unnamed units have a "dummy" name entered in brackets in the Formation field so that they can be distinguished from other units.

19 to 22. Sub1-unit, Sub2-unit, Sub3-unit, Sub4-unit
[D_SUB1UNIT, D_SUB2UNIT, D_SUB3UNIT, D_SUB4UNIT]:
These four fields are used for unnamed subdivisions below the Member level. Subunits are usually indicated by a single, lower case character, which is also used in the unit label. They are structured hierarchically to allow maps to be generalized at several different levels. For example, units may be divided into volcanic (v) and sedimentary (s) in Sub1-unit, and the volcanic units may be further subdivided into felsic (f) and mafic (m) in Sub2-unit. The felsic units can then be split again into flows (f) and pyroclastics (p) in Sub3-unit, and the pyroclastics into tuffs (t) and breccias (x) in Sub4-unit. Some units contain "(u)" in Sub1-unit. This is a 'dummy' entry used to facilitate sorting of the legend and the unit at this level is not geologically distinct from the named subdivision above it.

Lithofacies Fields
Five fields allow the map to be displayed in the same format as the 1:1-million scale map 90-01, Geology of the Island of Newfoundland (Colman-Sadd *et al.*, 1990). This map uses a tectonic lithofacies classification for units rather than a stratigraphic classification; the units are described on the legend in **Lithofacies_Legend.pdf**. Note that, although the legend is generalized to about the same level as on the printed 1:1-million scale map, the line work is not. As a result, the digital map shows the distribution of units in much more detail and with much more accuracy than the printed map.

23 and 24. Unit labels (lithofacies) [L_FULLABEL, L_DOMLABEL]:
As for the generalized and detailed units, field 23 shows the full label and field 24 shows the label for just the dominant unit. The labels are similar to those used on Map 90-01 and unit descriptions are given on the Lithofacies Legend.

Note that some Dunnage Zone units have been divided in two with "n" or "x" suffixes to distinguish between the Notre Dame and Exploits subzones, respectively. There are also a few units that are not represented on Map 90-01 because all their outcrop areas are too small to show at the 1:1 million scale.

25. Summary rock type (lithofacies) [L_ROCKTYPE]:
The entry comes from the standard rock types listed in **Rock_Types.pdf**. The field contains the phrase that most accurately describes the lithology of the dominant lithofacies unit in a polygon.

26. Tectonic division (lithofacies) [L_TECTDIV]:
The name of the tectonostratigraphic division to which the polygon belongs. Three divisions are used for rocks generated during the Appalachian orogenic cycle: 'Laurentian Margin', 'Iapetus Ocean' and 'Gondwanan Margin'. To these are added two divisions for post-orogenic overlap sequences and intrusive rocks.

27. Tectonic subdivision (lithofacies) [L_TECTSUB]:
The name of the tectonostratigraphic subdivision to which the polygon belongs. These are zones and subzones adapted from the classification of Williams *et al.* (1988).

Tectonic Assemblage Fields
The Tectonic Assemblage fields distinguish terranes in more detail than the lithofacies version. For example, the Notre Dame Subzone is subdivided into a number of different arc–back-arc systems; the units are described on the legend in **Tect_Assemb_Legend.pdf**.

28 and 29. Unit labels (tectonic assemblage) [A_FULLABEL, A_DOMLABEL]:
As for the generalized, detailed and lithofacies units, field 28 shows the full label and field 29 shows the label for just the dominant unit. The unit descriptions are given on the Tectonic Assemblage Legend.

30. Summary rock type (tectonic assemblage) [A_ROCKTYPE]:
The entry comes from the standard rock types listed in **Rock_Types.pdf**. The field contains the phrase that most accurately describes the lithology of the dominant tectonic assemblage in a polygon.

31. Tectonic division (tectonic assemblage) [A_TECTDIV]:
The name of the tectonostratigraphic division to which the polygon belongs. Three divisions are used for rocks generated during the Appalachian orogenic cycle: 'Laurentian Margin', 'Iapetus Ocean' and 'Gondwanan Margin'. To these are added two divisions for post-orogenic overlap sequences and intrusive rocks.

32. Tectonic subdivision (tectonic assemblage) [A_TECTSUB]:
The name of the tectonostratigraphic subdivision to which the polygon belongs. These are zones and subzones adapted from the classification of Williams *et al.* (1988).

Source Map Fields
33. Map ID [MAP_ID]:
Each polygon has been digitized from an existing hardcopy map. This field gives the Geological Survey of Newfoundland and Labrador Geofiles number for the map. Note that line work has not been changed from that shown on the original maps.

34. Unit ID [UNIT_ID]:
The unit label used for a polygon on the original published source map referred to in **Map ID**. Numbers in {brackets} following some unit labels distinguish different parts of what were originally single units and do not occur on the source maps.

35. Map number [MAP_NUMB]:
The number of the source map in the publisher's map series.

36. Publisher [MAP_PUBL]:
The publisher of the source map.

37. Map reference [MAP_REF]:
The short-form reference to the map from which the polygon was digitized. The full reference can be found in **Reference_List.pdf**. Note that this field corresponds to the only geological polygon attribute in the Map_Ref polygon file.

38. Map scale [MAP_SCALE]:
The scale of the published source map. Digitizing was generally done from source maps at publication scale and it has corresponding topographic accuracy. In a few cases, maps were digitized at more detailed scales than the published versions, using manuscript material.

Ordering Number Fields
These six fields are the same as fields 4, 10, 24, 27, 29 and 32, except that they have numeric prefixes that allow them to be sorted in a specific order. They are provided for use in GIS viewing software that creates screen legends of values in selected fields. Such software could use field 4 to make a screen legend of all the labels for top ranking units. However, it would have no means of sorting the labels in a geologically sensible way. If field 39 is used instead, the numeric prefix ensures that the labels are sorted with the oldest units at the bottom of the list and the youngest ones at the top. Once the labels are sorted, the prefixes can be deleted.

39. Dominant label ordering number (generalized) [ON_G.LABEL]:
Equivalent to field 4. Sorting is by age and older units have higher numbers.

40. Dominant label ordering number (detailed) [ON_D.LABEL]:
Equivalent to field 10. Sorting is by age and older units have higher numbers.

41. Lithofacies label ordering number [ON_L.LABEL]:
Equivalent to field 24. Sorting is by tectonic division and subdivision, rock class and age, and the order of units matches that on the **Lithofacies_Legend.pdf**.

42. Lithofacies tectonic subdivision ordering number [ON_L.TECT]:
Equivalent to field 27. Sorting is by tectonic division and subdivision.

43. Tectonic assemblage ordering number [ON_A.LABEL]:
Equivalent to field 29. Sorting is by rock class, tectonic division and subdivision, and age, and the order of units matches that on the **Tect_Assemb_Legend.pdf**.

44. Tectonic assemblage tectonic subdivision ordering number [ON_A.TECT]:
Equivalent to field 32. Sorting is by tectonic division and subdivision.

Colour Fields
The polygon attribute tables have three fields for Red, Green and Blue (RGB) for each level of detail. They also have **RGB quad** fields, which combine the three RGB values into single numbers using the formula ((red x 65536) + (green x 256) + blue); the **RGB text** fields store these values as text. The colour fields give the values preassigned to the polygons on the coloured versions of the polygon files. Although these values can be edited, editing has no effect on the colours of the polygons in these files. Use the uncoloured polygon files to produce a map with a customized colour scheme.

45 to 48. Generalized polygon colours [G_RED, G_GREEN, G_BLUE, G_RGBQUAD]:
The RGB values assigned to polygons in the generalized version of the map and corresponding to the generalized stratigraphic units distinguished by **Dominant label (generalized)** (field 4).

49 to 52. Detailed polygon colours [D_RED, D_GREEN, D_BLUE, D_RGBQUAD]:
The RGB values assigned to polygons in the detailed version of the map and corresponding to the detailed stratigraphic units distinguished by **Dominant label (detailed)** (field 10).

53 to 56. Lithofacies polygon colours [L_RED, L_GREEN, L_BLUE, L_RGBQUAD]:
The RGB values assigned to polygons in the lithofacies version of the map and corresponding to the lithofacies units distinguished by **Dominant label (lithofacies)** (field 24). The colours match those used on Map 90-01, 'Geology of the Island of Newfoundland'.

57 to 60. Tectonic assemblage polygon colours [A_RED, A_GREEN, A_BLUE, A_RGBQUAD]:
The RGB values assigned to polygons in the tectonic assemblage version of the map and corresponding to the tectonic assemblages distinguished by **Dominant label (tectonic assemblage)** (field 29).

61 to 64. RGB quad values as text [D_RGBText, G_RGBText, A_RGBText, L_RGBText]:
The RGB quad values (fields 48, 52, 56, 60) in text format for the four levels of detail.