

# A Summary Report on the Work Undertaken for the Nova Scotia Component of the Targeted Geoscience Initiative (Phase 2)<sup>1</sup>

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## Introduction

The Targeted Geoscience Initiative (TGI) is a national program designed to assist and promote mineral and energy exploration. Work on the second phase of this program (TGI-2) began during the summer of 2003 and the program ends April 1, 2005.

The Nova Scotia component of the current TGI program is a mapping and geological resource evaluation project which has focused on NTS areas 11E/06 and 11E/07 (see Fig. 1). The project includes new bedrock mapping, digital compilation of historical mapping data, mineral deposit research, geophysical modelling and regional geochemistry. A useful overview of the project is provided by Naylor *et al.*, 2004.

The purpose of this report is to provide a brief summary of the work undertaken during 2004. The report also includes a list of the products that will be generated by this project.

## Geological Mapping

The study area holds significant mineral and hydrocarbon resource potential. Higher quality bedrock maps and improved stratigraphic and structural models, however, are required to guide exploration efforts.

During the summer of 2004 we undertook selected bedrock mapping of Carboniferous strata on NTS areas 11E/06 and 11E/07. Particular attention was paid to defining stratigraphic boundaries and resolving structural questions. Work was also undertaken on locating and mapping small mafic intrusives that locally appear to cut Carboniferous sediments.

Both upper and lower Carboniferous strata can be found within the study area. The Upper Carboniferous strata have been assigned to the Cumberland Group. Based on our mapping over the last two field seasons we are able to subdivide the Cumberland Group into six formations. From oldest to youngest the formations are: Boss Point, Parrsboro, Totten Brook, Chiganois River, Cross Road and Debert River. The Boss Point and Parrsboro formations have been previously recognized outside the map area. The other formations are new subdivisions of the Cumberland Group.

The Lower Carboniferous within the project area includes strata assigned to the Mabou, Windsor and Horton groups. Lithostratigraphic subdivision of the Mabou strata has proven very difficult. In part this is due to the variable degree of alteration found within the unit. Mabou strata range from relatively unaltered to highly altered with extensive iron carbonate mineralization. In addition, palynological analysis of Mabou strata has been largely unsuccessful.

Work on the Windsor Group was generally confined to examining contact relationships between the Windsor and Horton groups. A considerable amount of time was spent mapping stratigraphic boundaries and structural relationships within the Horton Group. In the project area, it is possible to subdivide the Horton Group into the Horton Bluff and Cheverie formations. Murphy and Rice (1998) have proposed different subdivisions of the Horton Group in the study area and formally proposed new formation names. Although we recognize the value of Murphy and Rice's work, we have chosen to retain the lithostratigraphic subdivisions and terminology that correspond to the Horton Group type section.

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A full discussion of the Carboniferous stratigraphy and structure in the project area is beyond the scope of this report. Details about the structure, lithostratigraphy and palynological analysis can be found on the new 1:50 000 scale maps of NTS areas 11E/06 and 11E/07 that are being generated as part of this project. These maps will be available in 2005.

Small mafic and felsic intrusives are found locally within the project area. Contact relationships between these intrusives and the surrounding Carboniferous strata have never been closely examined. Our fieldwork shows that in some instances it is possible to demonstrate that mafic units intrude Lower and Upper Carboniferous strata. Through the use of airborne magnetic data we were also able to more accurately define the size and location of the intrusive units. Further information on intrusive bodies in the map area is found in O'Reilly (this volume, p. 73-92).

The project has provided funding to digitize and compile a large number of bedrock maps into ArcView® format. These include:

- GSC published and open file maps 1058a, 1215a, 3757, 3535, and 3703;
- twenty-one previously unpublished maps which formed part of the Nova Scotia Department of Mines St. Marys River Basin Project (see location, Fig. 1) undertaken from 1968-1971;
- four previously unpublished 1:5 000 scale maps illustrating the work undertaken as part of a NATMAP project (see location, Fig. 1) in the St. Marys Basin by Brendan Murphy and Randy Rice from 1993-94. These maps will be released as Nova Scotia Department of Natural Resources Open File Maps;
- new 1:50 000 scale maps of NTS areas 11E/06 and 11E/07, created using new mapping carried out for this project and compiled data from previous workers; and
- thirteen new 1:10 000 scale maps detailing the Upper Carboniferous strata adjacent to the Cobequid Fault from Londonderry to Kempton.

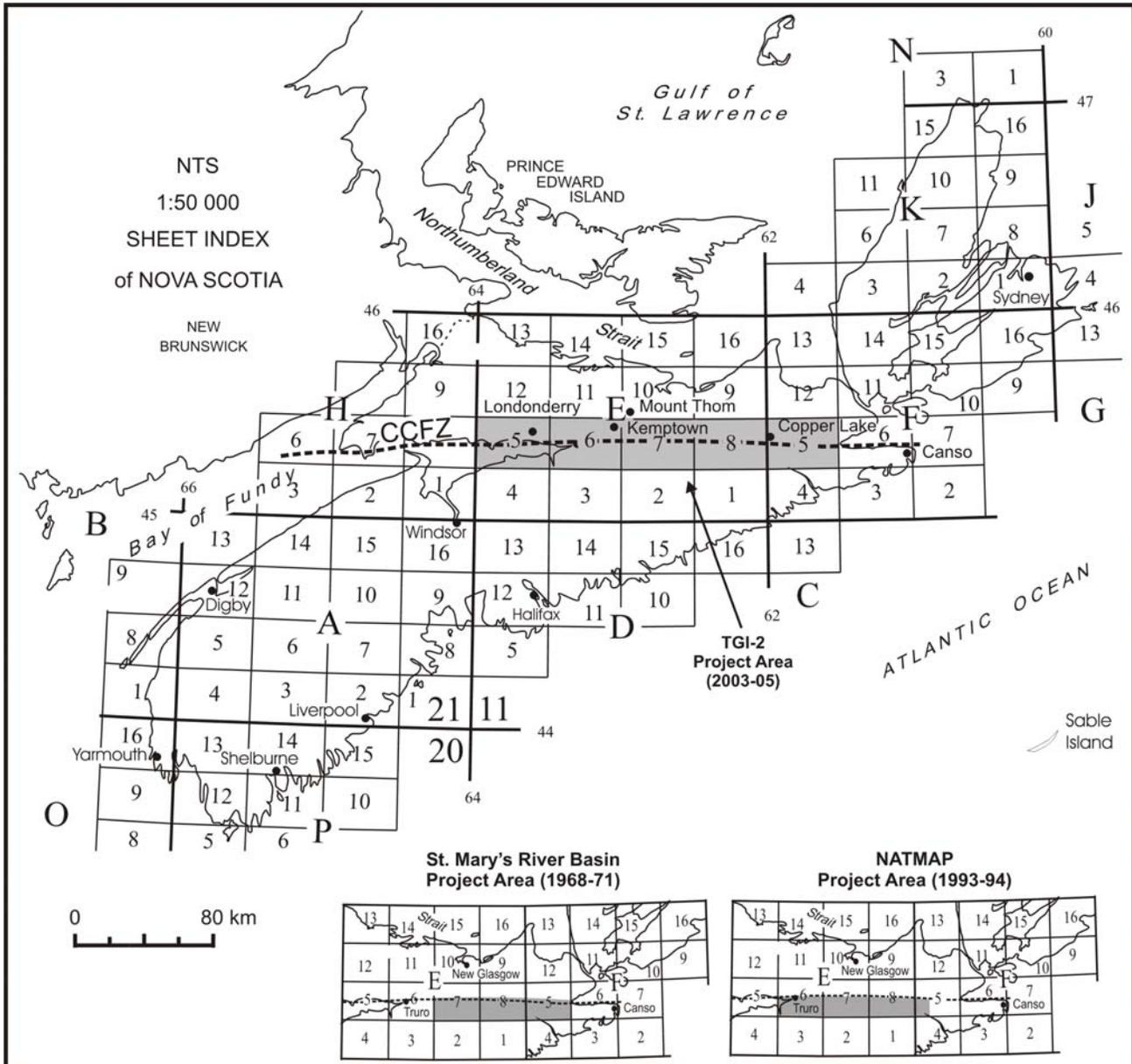
## Mineral Deposit Research

Work during the past year as part of the TGI-2

program included logging relevant drill core from the Copper Lake and Mt. Thom districts (see Fig. 1) in order to ascertain the nature of mineralization and the extent of wall rock alteration in these settings. Core logging and associated field studies indicate both areas are underlain by extensive haloes of carbonate (calcite, mixed Fe-Mg carbonates) and alkali (i.e. albite) metasomatism with associated introduction of base and precious metals (Au) as sulphides. Preliminary petrographic and detailed mineralogical studies indicate that enrichment of apatite, rutile, xenotime, monazite and zircon also occurs, part of the alteration assemblage. Thus, there was also introduction of P, Ti, Zr, and light rare earth elements (LREE) as part of the hydrothermal mineralizing event. Hydrothermal monazite and zircon are amenable to direct radiometric dating and this work is underway; thus, the age of the alteration/mineralization event can be ascertained. Preliminary compilation of results of C and O isotopic data and trace element geochemistry for the two areas and the Londonderry district, a former iron-producing area to the west, suggests that there may be a genetic connection among these districts. Ongoing work and data collection include additional petrography, whole-rock and mineral chemistry, mineral paragenesis and geochronology. These data will be integrated into models for mineralization in the study areas.

## Regional Surficial Geochemistry

During the summer of 2004 a total of 59 regional A-horizon humus, 59 B-horizon soil and 59 C-horizon till samples were collected from north-south transects across NTS map areas 11E/06, 11E/07, 11E/08 and parts of 11E/05 and 11E/12. The samples were collected in order to characterize the geochemical response of each sample medium, particularly where it is associated with the Cobequid-Chedibucto Fault Zone (Fig. 1). The samples are being analyzed using multi-element ICP-MS analysis by ACME Analytical Laboratories Limited of Vancouver, British Columbia. Analytical results are pending. A more detailed overview of this work is provided by Goodwin (this volume, p. 35-38).



**Figure 1.** National Topographic System (NTS) index map of Nova Scotia showing locations of the TGI-2 and previous project areas. CCFZ = Cobequid-Chedabucto Fault Zone.

## Geophysical Data

Some re-processing of historical seismic data was undertaken in 2004. The 1990 survey shot by Curragh Resources Ltd. in the Debert-Kempton Coalfield was selected as a good candidate for reprocessing. Unfortunately, the results were not encouraging. No significant improvement in quality was achieved. As a result further reprocessing of seismic data was suspended.

In contrast, new work on magnetic and gravity data has produced some very useful results. During 2003 we prepared regional geophysical maps for the entire project area. These maps included: aeromagnetic (total field, calculated first and second vertical derivative) maps, Bouguer gravity maps, residual Bouguer gravity maps, and VLF-EM line and ortho total field maps (local coverage only). These data are available as part of a series of 1:2 500 000 and 1:50 000 scale maps that cover most of northern mainland Nova Scotia.

During 2004 new high-resolution airborne magnetic survey data were generously made available by Avalon Ventures Ltd., Monster Copper Corporation, and Wallbridge Mining Company. Collectively the surveys covered most of the northern half of NTS 11E/07 and a small area of northwestern NTS 11E/06. We have used the data to create enhanced map images and 2½-D models to study distribution of mafic intrusions. The enhanced map images have significantly improved our understanding of the structural geology and Carboniferous stratigraphy. Similarly, modelling of mafic intrusives has provided very useful information about the location and depth of these bodies. A final report on this work will be released in August 2005.

Radiometric data have also provided some useful information for understanding the geology in the TGI-2 project area. The Radiation Geophysics Section (Mineral Deposits and Applied Geophysics Subdivision) of the Geological Survey of Canada has completed province-wide radiometric surveys at 1 km line spacing. Digital radiometric data were acquired by the Nova Scotia Department of Natural Resources and processed for this project to generate colour/contoured shaded relief map images. Although our main interest was the radiometric coverage for the TGI-2 project area we processed data and created images for the entire province. This work will be available in 2005.

## Future Work

All the products that had been planned for delivery as part of the Nova Scotia component of the TGI-2 program are published or in advanced stages of editing. The large amount of data generated by the project will be used to publish additional reports during 2005-06. These will include papers on the age of magmatic and mineralizing events in the Cobequid-Chedabucto Fault Zone and mineral paragenesis and alteration at Mount Thom and Copper Lake. Reports will also be prepared on the sedimentology, stratigraphy and depositional setting of late Carboniferous strata adjacent to the Cobequid Fault.

## References

- Murphy J. B. and Rice, J. R. 1998: Stratigraphy and depositional environment of the Horton Group in the St. Marys Basin, central mainland Nova Scotia; *Atlantic Geology*, v. 34 p. 1-25.
- Naylor, R. D., Fisher, B. E., Giles, P. S., Goodwin, T. A. and Kontak, D. J. 2004: Progress report on a new mapping and resource evaluation program for central Nova Scotia; *in* Mineral Resource Branch Report of Activities 2003; Nova Scotia Department of Natural Resources, Report 2004-1, p. 87-91.