

MINERAL INVENTORY PROJECT

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ABSTRACT

The primary mandate of the Mineral Inventory Project is to document geological and mineral resource information on the Province's mineral occurrences and to make the information available to the public. Mineral Inventory personnel are also responsible for reviewing selected land-use applications and environmental assessment projects submitted to the Provincial Government, with the aim of minimizing their impact on the Province's documented mineral resources and areas of high mineral potential.

INTRODUCTION

The Mineral Inventory Project maintains the principal repository for geological information on the Province's mineral resources. The repository consists of the Mineral Occurrence Data System (MODS), which is a digital mineral occurrence database containing over 7000 records.

The MODS consists of summaries of data including location, geological descriptions, mineralogy, deposit type, work histories, resource and/or reserve statistics, analytical results and bibliography on known mineral occurrences. It is an important mineral exploration and research tool that offers fast and easy access to mineral occurrence information throughout all of Newfoundland and Labrador. The main delivery point for the MODS data is the Geological Survey of Newfoundland and Labrador website (<http://www.nr.gov.nl.ca/nr/mines/Geoscience/index.html>).

Clients can search the database using either the 'Mineral Deposit (MODS) Index Search Form' or the 'Geoscience Atlas'. It provides clients with a current, high-quality, online mineral deposit database that helps further define the Province's mineral potential and increase its prospectivity.

MINERAL OCCURRENCE DATA SYSTEM (MODS)

The MODS data are housed within an Oracle database management system; however, data entry is achieved using an application of the Microsoft-Access database software (Stapleton *et al.*, 2005). Microsoft-Access connects to the Oracle database using object database connectivity technology (ODBC).

The MODS data are obtained from three main sources: mineral industry assessment reports and press releases, government reports and academic reports (Figure 1). Data are reviewed to ensure compliance with the MODS coding standards before information is delivered to clients as occurrence specific, mineral inventory reports *via* the Geoscience Atlas or the MODS query form. Fields from the MODS database record (Table 1) can be downloaded from the Geoscience Atlas, which gives clients the ability to use the data in a GIS environment.

The MODS internet application is dynamically linked to the Oracle database, which serves as the common platform for all of the Geological Survey's databases. This enables efficient sharing of information between the databases giving clients same-day access to updated information.

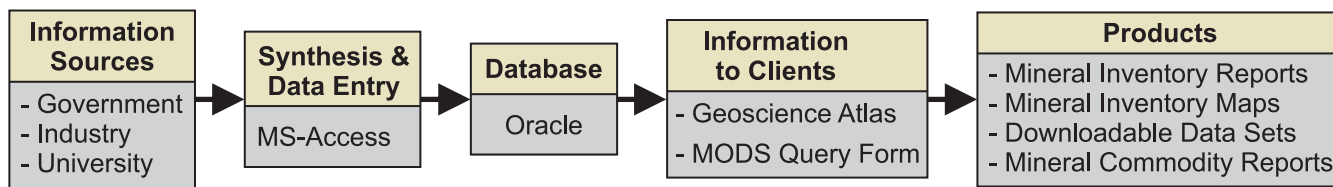


Figure 1. MODS flow chart.

Table 1. Fields and field descriptions from MODS for GIS record

Depname	Usual name
Altname	Alternate name
Recid	Record ID number
Nmino	National mineral inventory number
Comname	Major commodity present
Modslabel	Symbol for major commodity present
Commods	Secondary commodities present
Deptype	Deposit type; coded genetic classification of deposit
Desc	Description of deposit type
Status	Indicating amount of work done, and hence the amount of information available on a deposit
	Producer - Commodity is extracted for sale
	Developed Prospect - Reserves or demonstrated resources of the commodity can be calculated, but the commodity has not yet been produced (<i>i.e.</i> , three dimensional data plus grade)
	Past Producer Dormant - The commodity is no longer produced, although there are known reserves or demonstrated resources
	Past Producer Exhausted - The commodity is no longer produced and there are no longer reserves or demonstrated resources
	Prospect - Two-dimensional data and grade are available, but not enough data to calculate reserves
	Showing - Mineralization exists in outcrop with little information known about its spatial extent; assay data exists
	Indication - An indication of the existence of the commodity (<i>i.e.</i> , field observation, map symbol)
Depchar	Deposit description
Geoprov	Geological province
Tectbelt	Tectonostratigraphic zone
Strunit	Stratigraphic unit
Stratigrap	Stratigraphic age of the host unit
Rocks	Rock type(s) associated with deposit
Trench	Trenching? y = trenching done
DDH	Number of drillholes into the deposit
Working	Type of mine workings
	Underground - u,
	Open Pit or Quarry - o
	Underground and Open Pit - uo
Adit	Adit? y = adit present
Shaft	Shaft? y = shaft present
Utmeast	Easting coordinate
Utmnorth	Northing coordinate
Utmzone	UTM Zone

GENETIC CLASSIFICATION OF MINERAL MINERAL DEPOSITS FOR MODS

The MODS uses a hierarchical genetic classification system, illustrated using the “Hydrothermal, Structurally-Controlled Mineralization” classification in Table 2, to classify mineral occurrences. The model is based on the host rock type and the relationship between the mineralization and the host rock. The numerical codes, and code ranges for deposit types that are related, give the user the power to search MODS data using structured query language (SQL). The user can widen and narrow the scope of the search by using logic operators, *i.e.*, “<, >, =, and ”. The complete classification system is contained in Appendix B in the MODS Help File located at http://www.nr.gov.nl.ca/nr/mines/geoscience/mods_help.html.

The two broadest subdivisions in the classification system are 1) “Metallic (Ferrous and Non-ferrous) Rocks and Minerals”, Codes 000 to 499, and 2) “Industrial Rocks and Minerals”, Codes 500 to 799.

The Metallic occurrences are subdivided into four broad categories. These are, 1) Intrusive Associations, 2) Strata-bound Mineralization, 3) Hydrothermal, Structurally-Controlled Mineralization, and 4) Metamorphogenic Deposits. Each one can be further divided as illustrated in Table 2 to show sub-categories within a given category. For example, the user can select all “Hydrothermal, Structurally-Controlled Mineralization” using the SQL statement `Deptype >= 300` or `Deptype <= 331`, or the user can be very specific and select “Mesothermal Precious Metal Association” using the SQL statement `Deptype = 312`. “Deptype” is the name of the MODS database field that contains the code corresponding to the deposit type as per the classification system. The other three broad metallic classifications discussed above, as well as the Industrial Rocks and Minerals Classifications, are also subdivided in detail and can be queried using SQL.

SEARCHING AND DOWNLOADING MODS DATA

The Geoscience Atlas is a very good application for cursory analysis and downloading of MODS data without the need for third party software. However, it is recommended that users import the data into other GIS programs for detailed analysis. There are four ways to search the database using the Geoscience Atlas: key word search, attribute search, spatial search and custom query (Stapleton and Smith, 2018). The maximum number of hits that can be viewed in the Search Results dialogue box is 1000 per search.

The MODS data can be downloaded using the Tool icon on the Geoscience Atlas Map View. The process is “Tools/

Table 2. Genetic classification system for Hydrothermal, Structurally-Controlled Mineralization

300–399	
HYDROTHERMAL, STRUCTURALLY-CONTROLLED MINERALIZATION	
300	Undivided hydrothermal, structurally-controlled deposits
310–329	STRUCTURALLY-CONTROLLED VEIN SYSTEMS WITH BASE OR PRECIOUS METALS
310	Undivided hydrothermal vein systems
311–320	VEIN SYSTEMS ACCOMPANIED BY MINIMAL WALLROCK ALTERATION
311	Undivided vein systems accompanied by no or minimal wallrock alteration
312	Mesothermal precious-metal association (<i>e.g.</i> , the quartz vein type of Dubé, 1990, Deer Cove, Cape Ray) may include; Au, As, Sb, locally accompanied by base metals
321–329	VEIN SYSTEMS ACCOMPANIED BY SIGNIFICANT OR WIDESPREAD WALLROCK ALTERATION
320	Undivided vein systems accompanied by significant or widespread wallrock alteration
321	Precious-metal mineralization accompanied by aluminous alteration; includes most Newfoundland examples of epithermal-type mineralization, <i>e.g.</i> , Hickey's Pond, probably Hope Brook
322	Precious-metal mineralization accompanied by alkali-carbonate alteration; mesothermal examples include both broadly stratabound mesothermal mineralization in gabbroic sills (<i>e.g.</i> , Stog'er Tight) and alkali alteration and mineralization of granitoid rocks (<i>e.g.</i> , Rattling Brook, Western White Bay).
330–339	STRUCTURALLY-CONTROLLED MINERALIZATION NOT ASSOCIATED WITH VEINING
330	Undivided structurally-controlled deposits not associated with veining
331	Unconformity-related uranium deposits

Download Data/Mineral Occurrences/Extract Data". This method is used to download all of the MODS database records or a subset. To download all of the records turn on the MODS layer, zoom to the full extent of the map and follow the process outlined above. A subset of the data can be downloaded by geographically zooming to an area of interest and following the process above, or one can first search the database and download the results of the search using the same method. The data fields included in the downloaded record (Table 1) do not include the long text fields and are designed to be used in GIS programs.

MODS CLIENTS

The MODS is used by mineral explorationists to help guide their exploration programs. It is used daily by government geologists in land-use planning. Advice is given to various government departments through the Interdepartmental Land Use Committee referral process and the environmental assessment registration process on establishing wilderness areas, hydro developments, provincial and national parks, cottage developments, water reservoirs, *etc.*, so that, where possible, these developments do not proceed in areas deemed to have high mineral potential.

Since the early 2000s, the Geological Survey has produced a series of Mineral Commodity Reports (Table 3). They are short summaries of mineral commodities with emphasis on their geological settings and exploration potential and are intended to act as a bridge between summary

Table 3. Published Mineral Commodity Reports

Zinc and Lead	Number 1, 2000, revised 2008
Nickel	Number 2, 2000, revised 2005, 2008
Copper	Number 3, 2000, revised 2005, 2007
Gold	Number 4, 2005, reprinted 2008
Uranium	Number 5, 2009
Rare-earth Elements	Number 6, 2011
Iron Ore	Number 7, 2012
Fluorite	Number 8, 2013
Barite	Number 9, 2014

information of a promotional nature and the detailed information accessible through the MODS and the Geological Survey's Geofiles database. The MODS database is the critical reference for compiling these reports providing location data, occurrence descriptions, *etc.*

MODS and the National Orphaned and Abandoned Mines Initiative (NOAMI)

The National Orphaned/Abandoned Mines Initiative (NOAMI) is a co-operative Canadian program that is guided by an Advisory Committee consisting of the mining industry, federal/provincial/territorial governments, environmental non-government organizations and First Nations.

In June 2001, a multi-stakeholder workshop was held in Winnipeg to review the issue of orphaned/abandoned mine

sites in Canada and identify approaches for cleaning up these sites. Recommendations and guiding principles from that workshop presented at the September 2001 Mines Ministers Conference resulted in an action plan that received the support of the Mines Ministers. A national multi-stakeholder Advisory Committee on Orphaned/Abandoned Mines was subsequently established in 2002 and charged with undertaking the Action Plan. The Information Gathering Task Group was formed by the NOAMI Advisory Committee to address inventories and characterization of orphaned/abandoned mine sites.

Cal Data Ltd. (2005) was engaged by the NOAMI Advisory Committee to document sources of information available on the subject. They immediately recognized the contribution that “Mineral Inventory Databases”, available in most provincial jurisdictions, could make in contributing information. The following paragraph is taken from their 2005 report:

“Most Canadian jurisdictions maintain at least two relevant databases. The first type is directly related to the issue of Inactive Mineral Sites and tends to be quite restrictive about what site is admitted. The other type of database is often referred to as a mineral deposit or occurrence database. Within these mineral occurrence databases there are common occurrence classifications such as ‘Past Producer’ and ‘Developed Prospect’ that identify Mineral Sites that are relevant to an inventory of Inactive Mineral Sites. These databases tend to be inclusive of all sites within a jurisdiction, disregarding the ownership issue.”

The Province participated in the process and, like other jurisdictions (*i.e.*, British Columbia), realized that much of the background data on past producers were available in the Province’s Mineral Inventory Database (MODS). Subsequently, information on a subset of past producing mines from MODS was extracted and used as a basis for the Newfoundland and Labrador contribution. Presently, NOAMI references the MODS database as a source of information on Newfoundland and Labrador’s past producing mines (Figure 2).

MODS USER STATISTICS

The 2017 web server statistics for the Mineral Inventory Database indicate that it was accessed 52 690 times, representing an increase of approximately 70% over 2016 (Figure 3), and during the past thirteen years, it has been consistently used, averaging 28 587 hits per year. A hit is logged when the user opens a Mineral Inventory record. As illustrated in Figure 3, database usage strongly correlates with activity in the Province’s mineral exploration sector with an increase in claim staking apparent during the years of greatest database access. A detailed study of the 2013 web server statistics (Stapleton *et al.*, 2015) indicated that the database has a global audience, being accessed from one hundred countries, representing approximately half of the countries of the world. It is accessed most frequently from Canada and the commodity of greatest interest is gold.

2018 UPDATES

Updates in 2018 were implemented on a Province-wide basis using data mainly taken from mineral industry assess-

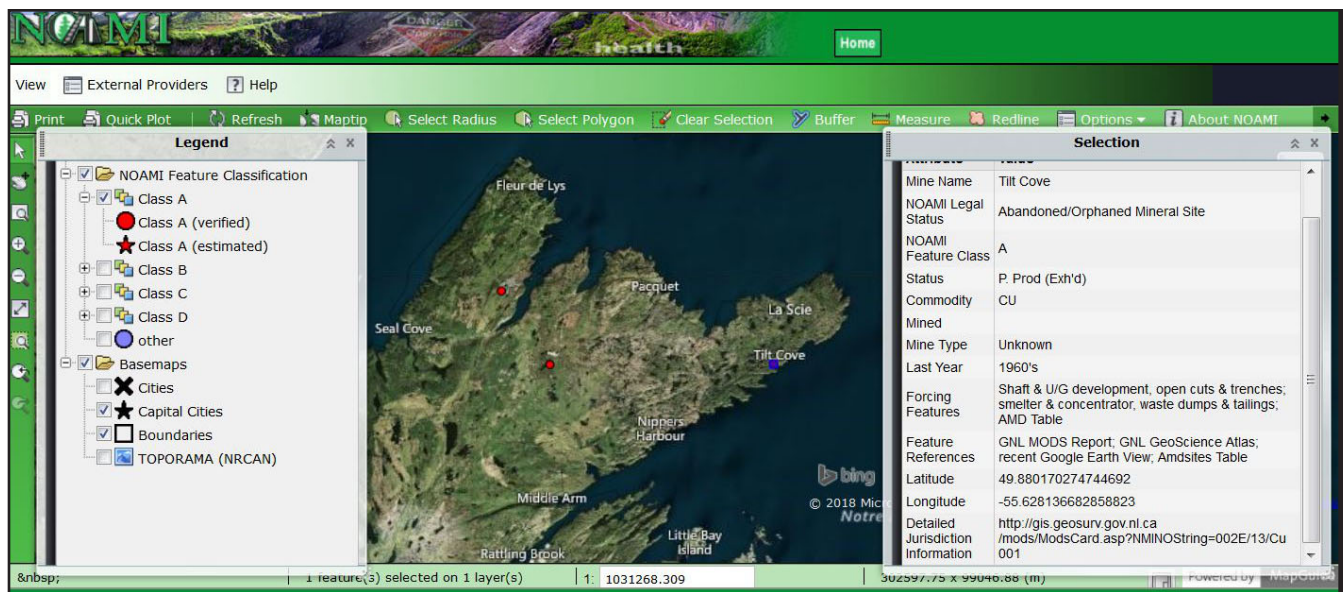


Figure 2. MODS and the NOAMI data viewer.

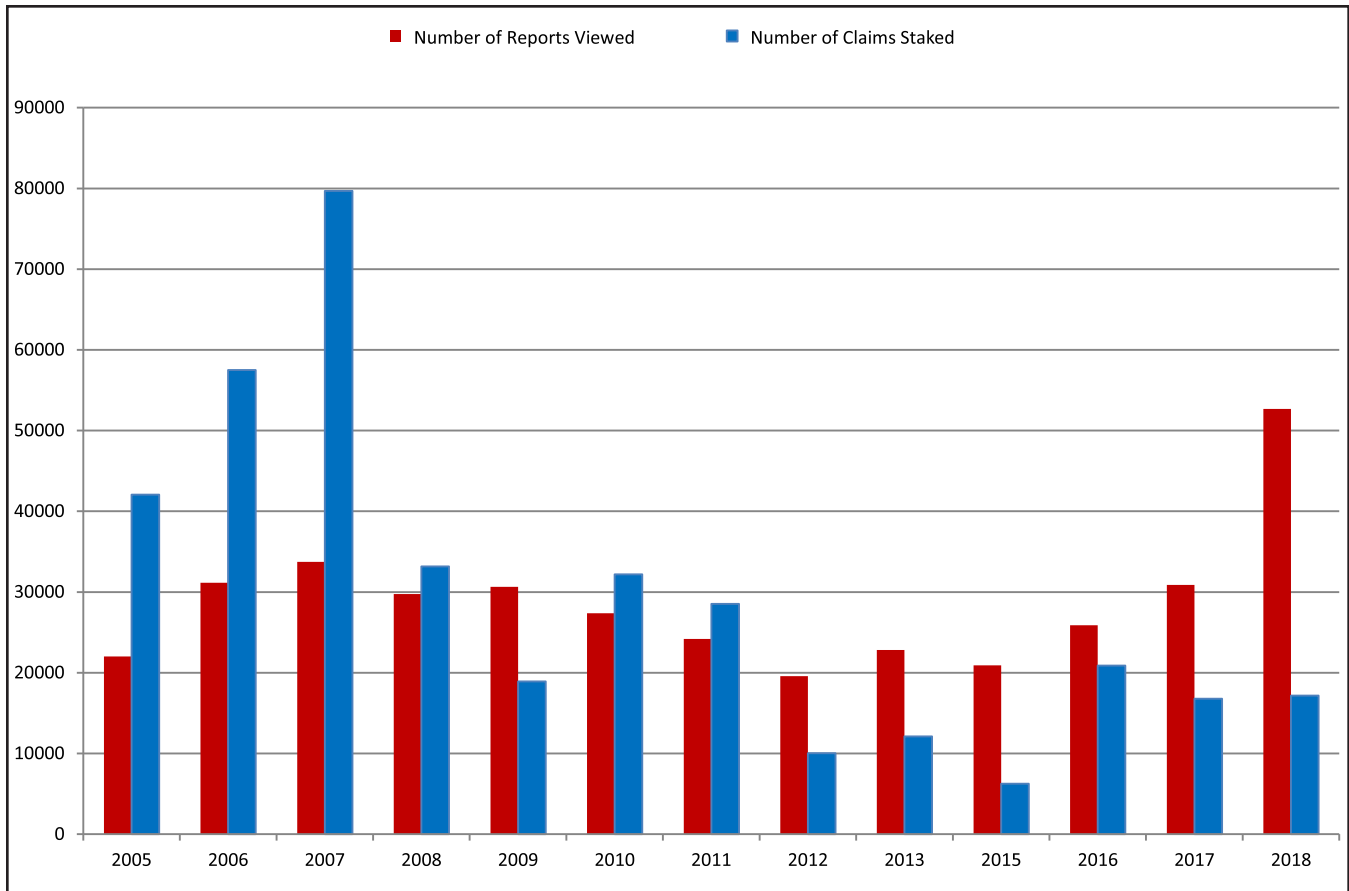


Figure 3. Number of reports viewed and claims staked per year 2005–2018 (data for 2014 unavailable).

ment reports, press releases and government reports. A focus was placed on volcanogenic massive sulphide mineralization hosted by the volcanic terrains of central Newfoundland, and mineralized gabbros and sulphide-rich shales of the eastern Labrador Trough. Areas updated include parts of NTS map sheets 1M, 2C, 2D, 2E, 2L, 2M, 11O, 12A, 12B, 12H and 12I (Newfoundland) (Figure 4), and 3D, 13B, 13L, 13M, 13N, 23I and 23O (Labrador) (Figure 5).

Consistent delivery of MODS data continued to be achieved through both the query form and the graphical interface, with both updated and new non-confidential records copied to the public domain on a 24 hour basis. This update provides the mineral exploration sector and other clients with a more current dataset that helps further define the Province's mineral potential and prospectivity. The data generated by the Mineral Inventory Project contributes toward longer term benefits evidenced by increased investment in the provincial mineral exploration and mining industries (Stapleton *et al.*, 2014).

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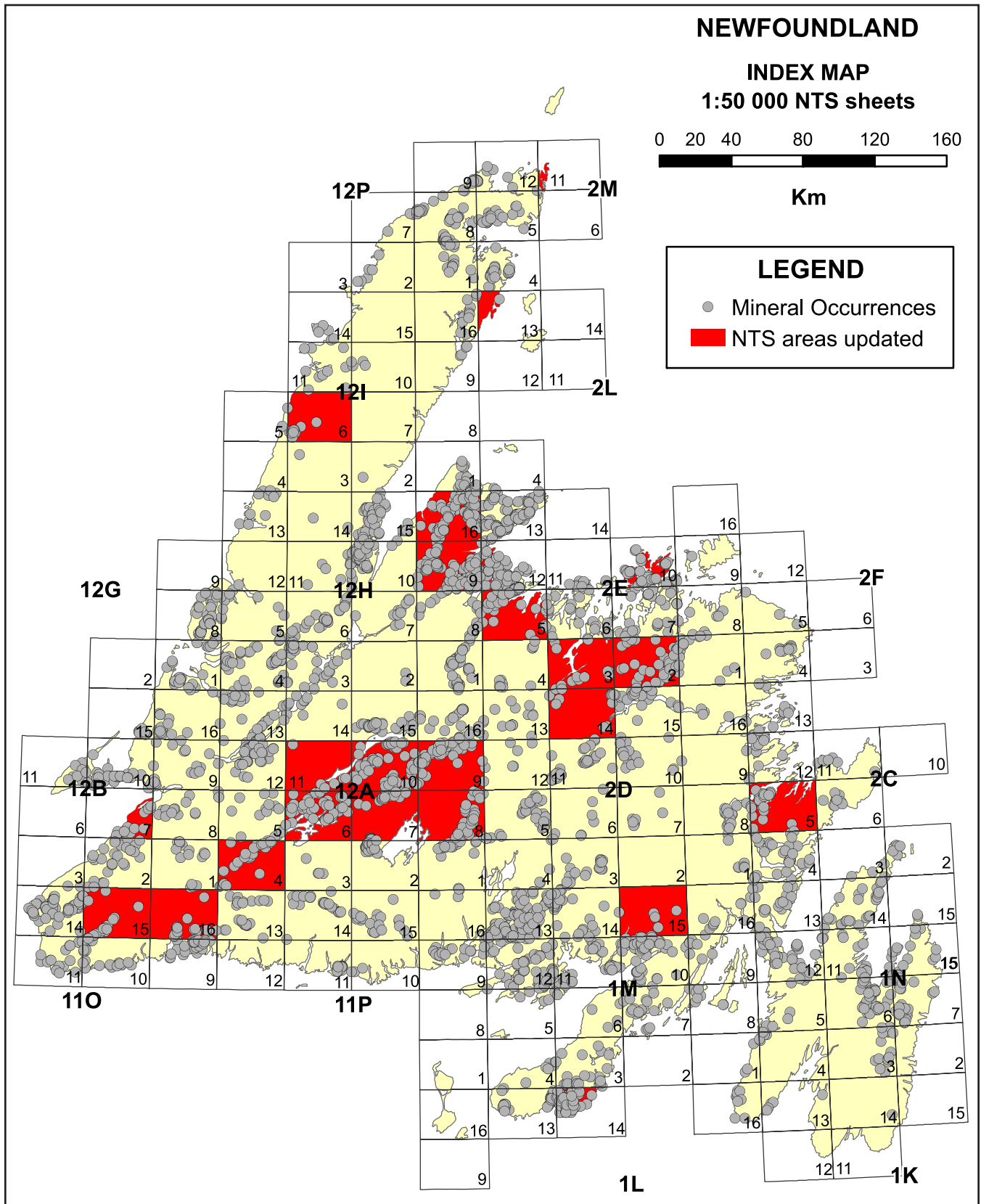


Figure 4. NTS areas updated, Newfoundland.

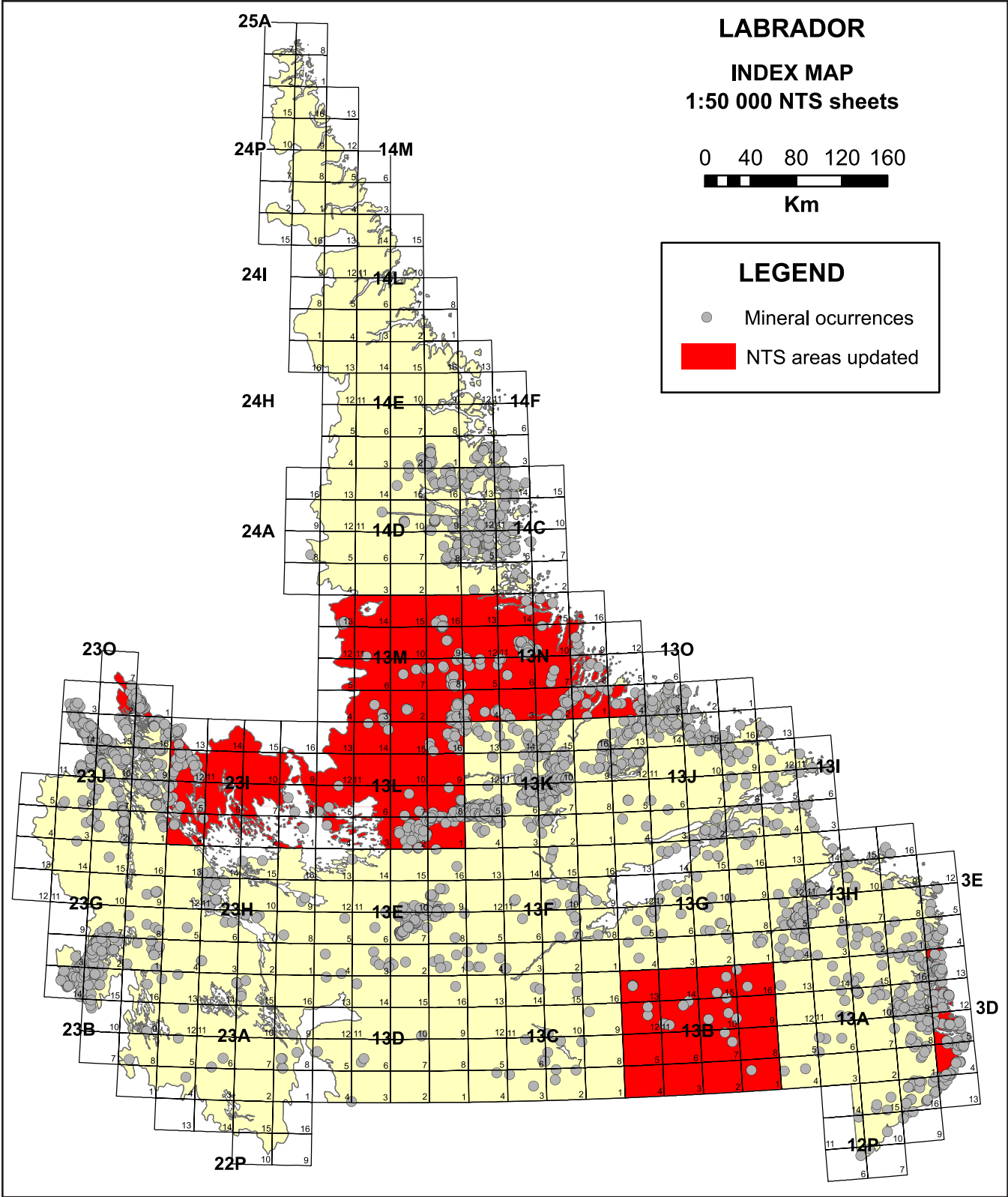


Figure 5. NTS areas updated, Labrador.

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