

# THE GEOSCIENCE ATLAS: OPTIMIZATION AND UPDATES

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## ABSTRACT

The *Geoscience Atlas* (Atlas) website is the Geological Survey of Newfoundland and Labrador's (GSNL) internet portal to view, query, download, and print Newfoundland and Labrador geoscience data. This review of the Atlas tools, help files, setup procedures, recent data updates and a new platform technology will aid users in maximizing their use of the Atlas.

Updates to datasets delivered through the Geoscience Atlas are made at different intervals, depending on the type of data. Along with the layers updated in real time (i.e., Map Staked Claims) and updated daily (e.g., Mineral Occurrence, Historical Claims and Quarry layers), many other layers on the Atlas are updated annually or biannually. The most recent update, in June of 2021, included a wide variety of layers from the following Atlas Groups: Map Layers, Coastal Monitoring, Indexes, Geochemistry, Bedrock Geology and Surficial Geology. The specific layers are listed in the 'What's New' file (<https://geotlas.gov.nl.ca/custom/help/whatsnew.html>).

The Geological Survey is also actively engaged in modernizing and improving the public geoscience data delivery interface. A transition to the Esri ArcGIS Online cloud-based platform is planned, to ensure that the Geoscience Atlas continues to better meet the needs and requirements of the mineral exploration industry and other GSNL clients and stakeholders. A pilot project was initiated in 2019, based on converting the Geoscience Atlas Indexes Group to the ArcGIS Online *Geoscience Index of Newfoundland and Labrador*. This application was developed to test the functionality of a cloud-based solution for improvements in both client interfacing and technical aspects of data management and Atlas updating. The cloud-based platform will allow flexibility in producing targeted applications for focused geoscience subjects.

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## INTRODUCTION

The Geoscience Atlas (Atlas) is the provincial internet portal to view, query, and output (download or print) geoscience data pertaining to the province of Newfoundland and Labrador (NL). Through this portal, the Geological Survey is able to communicate geoscience information directly to its stakeholders and clients in formats that are integrated directly into various geographic information system (GIS) software and other geoscientific analysis packages.

The geoscience datasets produced by the GSNL, and published on the Atlas, include over 180 individual data layers and more than 200 sublayers of geochemistry dot plots, contours and images. Ancillary layers produced and maintained by other government agencies, such as the location of forest-access roads and transmission lines, are also available through the Atlas.

The Atlas is updated regularly; the update frequency varies by type of information. Foundational geoscience

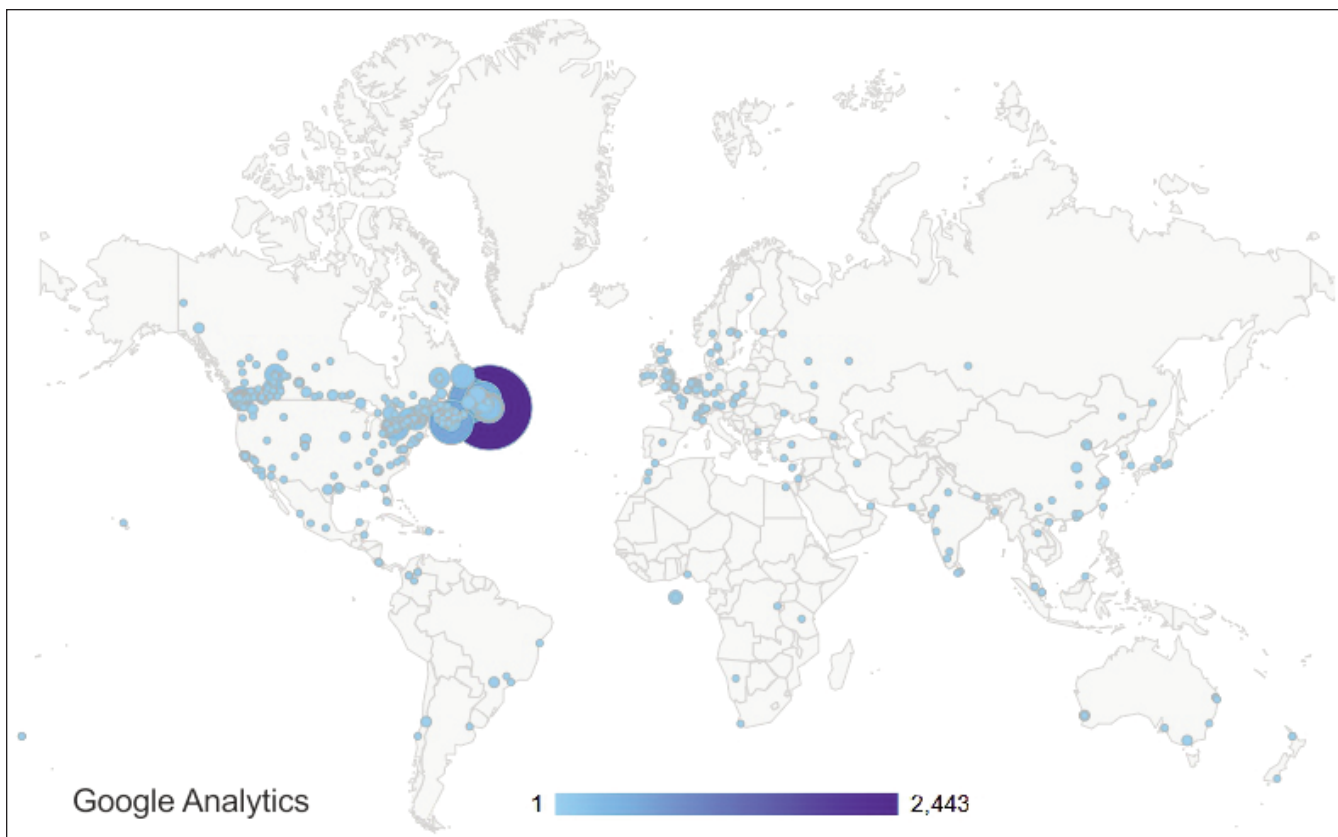
information (e.g., geochemistry, surficial geology, geophysics) updates are made annually or bi-annually. Other layers that pertain to mineral rights and mineral exploration (e.g., *Mineral Occurrences*, *Map Staked Claims* and *Quarry* layers) are automatically updated daily or in real-time. Linked help files and metadata pages are updated on an "as needed" basis.

Worldwide (Figure 1), over 9000 clients used the Atlas from October 27, 2020 to October 26, 2021. Data from Google Analytics indicate that over 43 000 sessions were logged on the Atlas during this time frame.

## USING THE GEOSCIENCE ATLAS

### GEOSCIENCE ONLINE

The GeoScience OnLine webpage (<https://gis.geosurv.gov.nl.ca/>) is the recommended portal to access the Newfoundland and Labrador Geoscience Atlas. GeoScience OnLine is the only site that provides Atlas announcements such as scheduled update or maintenance windows. The



**Figure 1.** Location and relative proportion of clients who used the Geoscience Atlas from October 27, 2020 to October 26, 2021.

GeoScience OnLine webpage’s primary function is to provide links to provincial and national services such as the Mineral Lands Claim Staking system (MinLAP), Geofiles Metadata Search, Mineral Rights Inquiry Portal, Geological Reports and Maps and the Mineral Occurrence Data System (MODS). Links to relevant free datasets maintained by the Government of Canada (*e.g.*, topographic and geoscientific) are also provided.

### ATLAS FUNCTIONALITY

A review of the Atlas layout and tools (Figure 2), help files, optimal settings and troubleshooting tips highlighted below, will familiarize the user with the Atlas and ensure ease of use. The Atlas Tutorial help file provides an overview of the Atlas, how to use the tools, and which layers (*i.e.*, geographic datasets, such as geology maps or lake-sediment sample sites and ancillary information) are available.

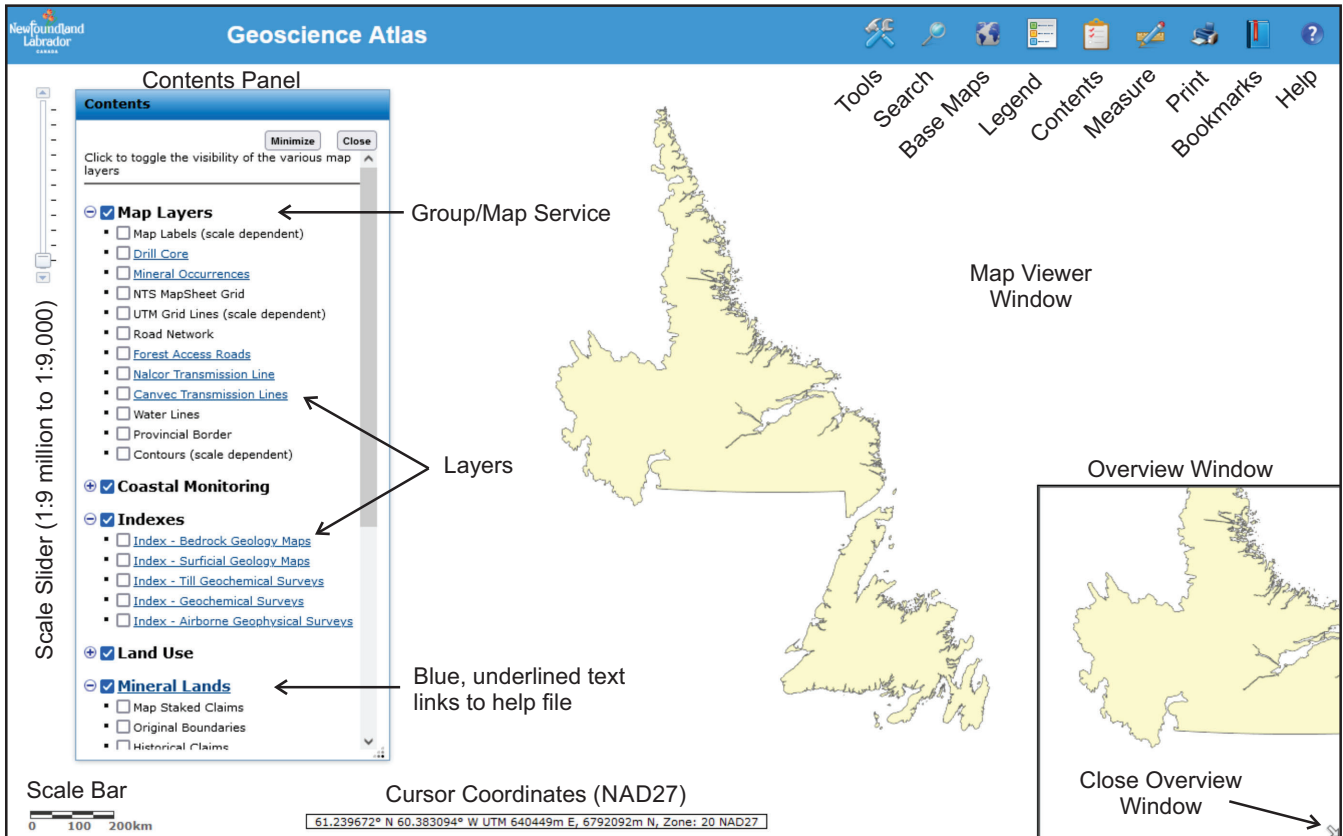
The present Atlas employs Esri ArcGIS Server technology. It offers many standard GIS functions and tools (Figure 2) in a virtual environment, including viewing layers, adding layers from other online sources (*i.e.*, Tools > Add Map Service), querying the data, downloading geoscience data based on map viewer extents and printing maps to

scale. Many of these tools are located in the Tools menu (Figure 3). Examples of how to use these tools are outlined in various help files described below.

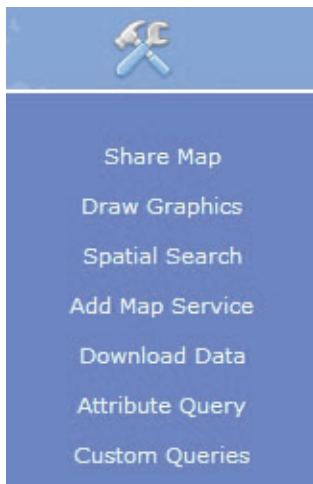
### Help Files

The Atlas HELP icon (“?”), on the far right of the menu bar (Figure 3), provides access to further links to answer such questions as how to navigate around the Atlas, what tools are available, how to use them, what layers are available and how the data was compiled. The following list describes the help files available:

- **Atlas Help:** provides a linked list of the help files as well as a description of the Atlas tools
- **Atlas Tutorial:** provides an overview of the Atlas tools and layers, and a graphic description of the layer or how to use the tool. The second page provides a hyper-linked Content page to quickly go to the tool or layer of interest
- **Frequently Asked Questions:** provides answers to commonly asked questions such as ‘what data can I download and what format and projection (including datum)



**Figure 2.** The Geoscience Atlas webpage layout. The scale slider and contents panel are located on the left side. The scale bar, cursor coordinates (based on the North American Datum of 1927 (NAD27)) and overview window are located along the bottom. Tools, Base Map options, Legend generator, Print, Help file links, and additional function buttons are located in the menu bar across the top right.



**Figure 3.** The Tools menu in the Geoscience Atlas provides an additional seven GIS tools. These tools are described in the help files Atlas Help>Tools and Atlas Tutorial.

- **What’s New:** provides a summary list of when the layers were updated on the Atlas
- **Layer Help Files:** available through the Atlas Contents panel. All blue underlined layer names link out to a metadata file describing the layer and further information, such as, how the data was compiled, a description of the variables, units and analysis methods, disclaimer, layer citation, references and contact information.

### ATLAS TROUBLESHOOTING

Setting up the internet browser correctly and being aware of the various limitations will minimize issues when using the Atlas. The Atlas has been optimized to work with the latest versions of the browsers Internet Explorer, Edge, Mozilla Firefox and Google Chrome. In its present configuration, it does not work on tablets or mobile devices.

Adding ‘ad blockers’ to your browser will cause problems with the Atlas Contents panel – the ability to expand the groups, to view the layers, will not be possible. To

will it be in’, ‘how do I colour the Bedrock or Surficial Geology polygons’

- **List of Layers:** provides a short description of each layer available on the Atlas

remove the ‘ad blocker’ problem, set up an ‘ad blocker’ exception for the Atlas in your browser by entering the website URL <https://geoatlas.gov.nl.ca/>.

Many users block pop-up windows on their browsers but pop-up windows are necessary for the Atlas to function (e.g., the Search Results window is a pop-up). To view pop-up windows, in the browser settings, enter the Atlas URL in the ‘exceptions’ section of the pop-up blocker dialogue box.

There are a large number of layers available in the Geoscience Atlas Contents panel: over 180 layers of data including over 110 raster layers in the *Geophysics Group* and over 200 sublayers of dot plots, contours and images in the *Geochemistry Group*. This makes it difficult to find the correct layer in drop-down layer lists, such as in the query, search or download tools. To simplify this task, make sure that the Contents panel has the Groups listed in the following order so they will be available in the drop-down lists in the same order: *Map Layers*, *Coastal Monitoring*, *Indexes*, *Land Use*, *Mineral Lands*, *Geochemistry*, *Bedrock Geology*, *Surficial Geology* and *Geophysics*. If the Groups are not in this order, refresh the Atlas window a few times until the order is as listed above.

The Atlas is designed to be accessed by many clients simultaneously, but if large numbers of clients query data simultaneously the system may crash. Therefore, there are limitations on the query results – only the first 1000 features will be listed in the Search Results window. For example, an Attribute Query search on the *Regional Lake Sediment Sites* for “Au1\_ppb > 4” will result in 1387 sites found but only the first 1000 sites will be listed in the Search Results window (Figure 4). The full set of 1387 values can be viewed by downloading the full lake-sediment dataset and querying it in a desktop GIS, such as QGIS. Alternatively, a set of queries can be set up to select, for example, “Au1\_ppb > 5” and then another query can be set up to select “Au1\_ppb > 4 AND Au1\_ppb <= 5”.

The Search tool (magnifier icon on the top menu bar, Figure 2) provides a powerful way to search for any text in the attribute tables of individual geoscience layers, groups or the whole Atlas database, but will still be limited by the 1000 record maximum in the Search Results window. Using Search for “Locations” may be difficult if the search term is a common town or site name. The Search tool uses the Google Maps database for locations that defaults to U.S. locations first, so the Province abbreviation should be added to all searches. For example, a search on “Pasadena” will return a blank map viewer window in the vicinity of Pasadena, CA, USA. Changing the search parameter to “Pasadena, NL” will result in the map viewer window zooming in to display the correct location in this Province. Some locations may also require “Canada” to be entered because “NL” is the country code for the Netherlands. Use the Bookmarks menu to return a blank map viewer window to Newfoundland, Labrador or Initial Extents (i.e., Newfoundland and Labrador).

## GEOSCIENCE ATLAS UPDATES 2021

The Atlas foundational geoscience information (e.g., geochemistry, surficial geology, geophysics) is updated annually or bi-annually with new data, newly compiled data, corrected or otherwise augmented data, and links to reports by GSNL personnel. A few layers are updated in real time (i.e., *Map Staked Claims*) or daily (e.g., *Mineral Occurrence*, *Historical Claim* and *Quarry* layers). Help files and metadata pages are updated on an “as needed” basis.

The most recent updates, in June of 2021, included additions, modifications, or corrections to the following:

- Map Layers Group: *Drill Core* and *Forest Access Roads* layers;
- Coastal Monitoring Group: added southeast *Labrador Coastal Indices* and *Coastal Characterization* layers;

	RECORD	SAMPLE_ID	NTS	AG3_PPM	AG6_PPM	AS1_PPM	AS19_PPM	AS21_PPM	AU1_PPb
<a href="#">zoom</a>	6428	773556	13G	0.2	-9	0.2	-9	0.5	45
<a href="#">zoom</a>	8185	831075	13K	0.1	-9	50.3	39.5	-9	6
<a href="#">zoom</a>	355	841004	13A	0.1	-9	57.6	0.5	-9	12
<a href="#">zoom</a>	8737	833119	13K	0.2	-9	2	0.5	-9	5

**Figure 4.** The Search Results window indicating the maximum of 1000 records listed out of a total of 1387 possible records.

- Indexes Group: *Index for Bedrock and Surficial Geology Maps*, *Index for Till Geochemical Surveys*, *Index for other Geochemical Surveys* (i.e., lake, rock, soil, stream and other material surveys) and *Index for Airborne Geophysical Surveys* layers;
- Geochemistry Group: *Till Sediment Geochemistry* layer updated for Great Burnt Lake (NTS 2D/03, 06), Star Lake (NTS 12A/05, 11, 14), Twillingate (NTS 2E/07, 10), Dead Wolf Pond (NTS 2D/10), Cormack (NTS 12H/06) and Silver Mountain (NTS 12H/11) areas;
- Bedrock Geology Group: added links to maps in PDF format (including legend, notes and references) for *Southeast Labrador Bedrock Geology* layer;
- Surficial Geology Group: *Carbon 14 Age Dates*, *Striations* and *Landforms* layers (discussed in more detail in the following section);
- Help Files: including the Atlas Help, Frequently Asked Questions, List of Layers and individual layer help files, such as the Bedrock Geology Help File, linked through the Atlas Contents panel;
- “What’s New” Summary: The What’s New file provides a complete list of layer updates with the date of the latest update.

## HIGHLIGHT: SURFICIAL DATA UPDATES

The Surficial Geology Group and surficial layers in the Indexes Group received the largest number of layer updates in 2021. A significant contribution was the addition of a digital compilation of surficial landform features ( $n \approx 28\,000$ ) for southern Labrador, added to the *Landform Lines NL* layer (Figure 5). These data were compiled from a series of 13 NTS 1:250 000 maps by Fulton *et al.* (1975), of the Geological Survey of Canada, that were published in the early 1980s (e.g., Fulton *et al.*, 1981). The extent of the compilation ranges from Hopedale, in the north, to the Strait of Belle Isle, in the south, and from Churchill Falls, in the west, to the Labrador coast, in the east. Data from this layer can be used to help classify sediment type (critical for till sampling), identify trends in glacial movement and aid in deciphering the glacial history of southern Labrador.

Additionally, a series of 27 surficial maps at the 1:50 000 scale are being prepared for addition to the Atlas. These maps were produced in the 1980s (Ricketts, 1984, 1987), and focused on identifying aggregate resources in the vicinity of the southeast Labrador coastal communities to provide information for resource conservation, municipal development and land-use planning. Mapping was conduct-

ed primarily by airphoto interpretation, from Lodge Bay in the south to Nain in the north, with field mapping and sampling completed in 1983 and 1984. The aggregate information was previously incorporated into the *Aggregate* layers but other surficial information is only now being digitized and added to the *Landform Lines 50k*, *Landform Points 50k* and *Detailed Surficial Geology* layers. During the digitization process, Terrain Science geologists updated the original surficial maps by correcting polygon labels and resolving mismatched polygons at map sheet boundaries through historic and modern airphoto re-interpretation.

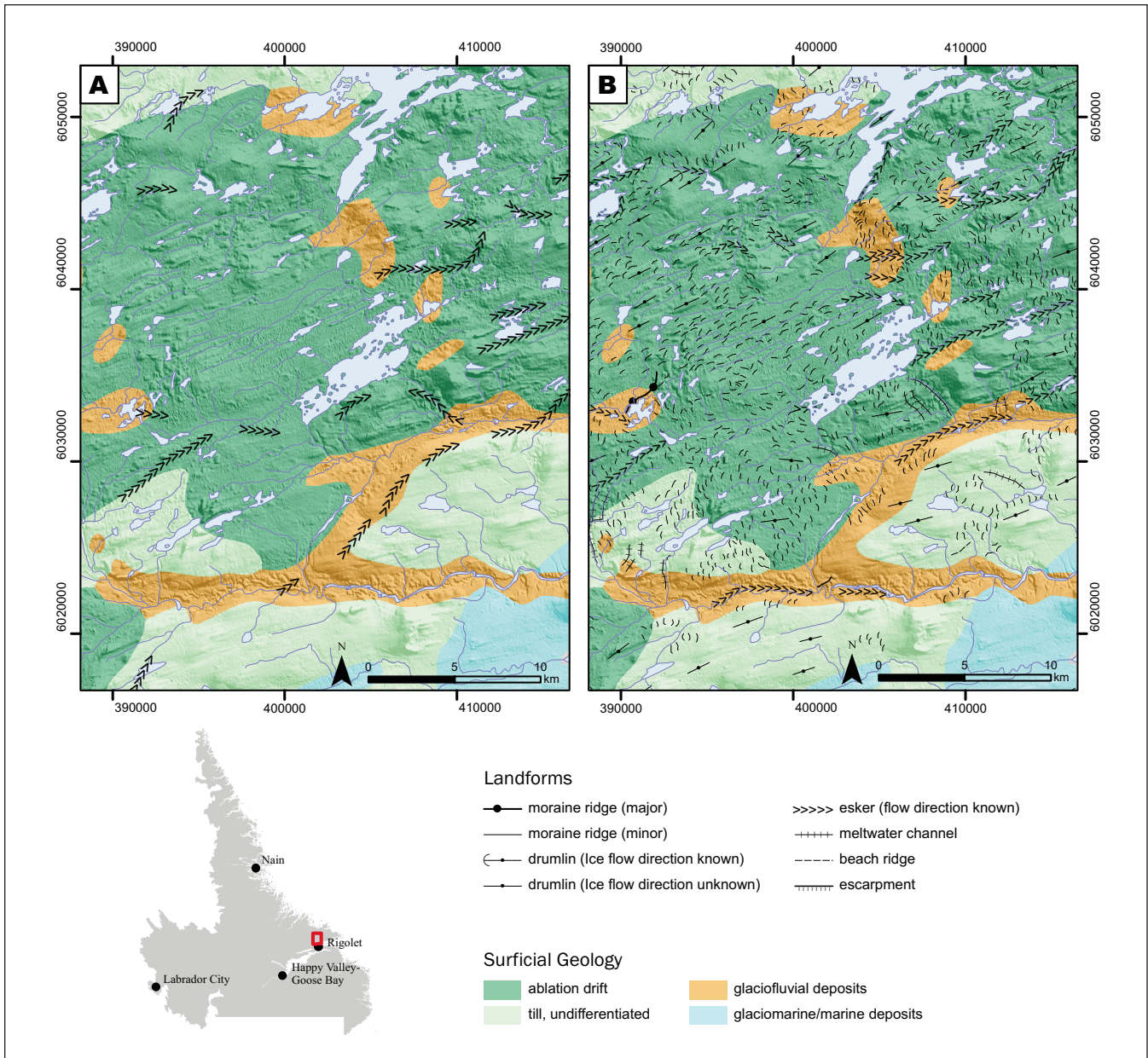
An extensive review of the *Carbon 14 Age Dates* layer was conducted to remove duplicates, verify site locations and ensure references were complete and accurate. This review resulted in the removal of 62 records from the database. The *Striations* database was updated with 70 new records, including 18 in Labrador.

In the Indexes Group, two new surficial geology maps (Cormack (NTS 12H/06) and Silver Mountain (NTS 12H/11) areas in western Newfoundland), were added to the *Index of Surficial Geology Maps*. The *Index of Till Geochemical Surveys* layer was also updated with links to the recent till surveys in the following map sheets: NTS 2D/03, 2D/06, 2D/10, 2E/07, 2E/10, 12A/05, 12A/11, 12A/14, 12H/06, 12H/11.

## CONCLUSIONS AND FUTURE ENHANCEMENTS

The Geoscience Atlas is the main portal for clients to access various geoscience datasets. The current Atlas interface, developed to leverage the Esri ArcGIS Server technology, was launched in March of 2014. Whereas this is a valuable tool in its current configuration, the GSNL is committed to ensuring that data delivery is aligned with the requirements of the current and future exploration industry, and other clients.

The Geological Survey is developing a roadmap for migration to a modernized version of the Atlas that leverages the Esri cloud-based mapping platform, ArcGIS Online. A pilot ArcGIS Online application was developed and launched in 2019. The interactive web map, the Geoscience Index of Newfoundland and Labrador, displays the geoscience indexes of bedrock and surficial geology maps, till geochemical surveys, other geochemical surveys (e.g., lake, rock, and stream surveys), and airborne geophysical surveys. In the app, users can easily query the indexes for a specific area of interest, and access published maps, reports and datasets. From a client perspective, index map queries can be similarly accomplished in the current Geoscience Atlas, but the technical barriers to updating an



**Figure 5.** An example of the landform line features in an area north of Rigolet (red square in inset map of Labrador) before (A) and after (B) the addition of the Geological Survey of Canada landform data compiled by Fulton et al. (1975). This update is a significant addition for Atlas clients.

“app” are significantly lower, which permits faster and more frequent updates.

The ArcGIS Online cloud-based platform would provide users with many of the same tools currently available in the Geoscience Atlas, along with other interactive mapping applications (“apps”) and an enhanced analysis toolbox. This new platform would also offer more options for a seamless mobile, tablet and desktop interface with GSNL data, and handle larger volumes of concurrent users. Furthermore, the transition would permit the rapid develop-

ment and deployment of targeted “apps” for common client searches, such as ‘Bedrock Geology’, or for delivery of timely information relevant to exploration themes, such as ‘Gold in Newfoundland’ or ‘Critical Minerals of Newfoundland and Labrador’.

The Geoscience Atlas is the Province’s premier resource for viewing and obtaining Newfoundland and Labrador geoscience information and data products. With new and updated layers, and future improvements in platform technologies, the Geoscience Atlas will continue to

provide support for a wide range of GSNL clients, from the mining and exploration industries, across other provincial and local government departments, to environmental firms and educational institutions.

An email address ([GeoscienceOnline@gov.nl.ca](mailto:GeoscienceOnline@gov.nl.ca)) is available for any Geoscience Atlas questions, as well as constructive comments.

## REFERENCES

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