



An interactive historical drillhole database for Nunavut

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The Nunavut Assessment Drill Database (NADD) is an ongoing project led by the Northwest Territories & Nunavut Chamber of Mines and funded by the Geo-mapping for Energy and Minerals program of Natural Resources Canada, with 'in kind' contributions from the Government of Nunavut, Crown-Indigenous Relations and Northern Affairs Canada, the Canada-Nunavut Geoscience Office, Peregrine Diamonds Ltd., Agnico Eagle Mines Ltd. and Auryn Resources Inc. The project compiles and presents data from the years 1995 to 2017, covering all portions of Nunavut.

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Abstract

Since early 2018, the Geo-mapping for Energy and Minerals program has funded three phases of the Nunavut Assessment Drill Database Project. Data products were completed and released on the Northwest Territories & Nunavut Chamber of Mines website in March 2018, March 2019 and December 2019.

The Nunavut Assessment Drill Database Project is a compilation of data from public-domain reports submitted for mineral-tenure assessment credits and available from the online 'NUMIN Gateway' of NunavutGeoscience.ca, which is a joint initiative of the Canada-Nunavut Geoscience Office, Crown-Indigenous Relations and Northern Affairs Canada, the Government of Nunavut, Natural Resources Canada and Nunavut Tunngavik Incorporated. The physical library is maintained by Crown-Indigenous Relations and Northern Affairs Canada. The database incorporates information on drillhole locations and selected drilling parameters, and presents them in an interactive, user-friendly, browsable format. The major goal of the project is to support mineral exploration by making data more readily available and usable. It is a value-added product employing pre-existing geoscience information.

Résumé

Depuis le début de 2018, le programme de géocartographie de l'énergie et des minéraux a financé trois phases du projet de base de données sur les forages d'évaluation du Nunavut. Des produits liés à ces données ont été achevés et publiés sur le site Web de la Chambre des mines des Territoires du Nord-Ouest et du Nunavut en mars 2018, en mars 2019 et en décembre 2019.

Cette base de données constituée à partir de rapports du domaine public soumis aux fins d'obtention de crédits d'évaluation de droits miniers est accessible en ligne sur le site « NUMIN Gateway » à l'adresse NunavutGeoscience.ca., soit une initiative conjointe du Bureau géoscientifique Canada-Nunavut, de Relations Couronne-Autochtones et Affaires du Nord Canada, du gouvernement du Nunavut, de Ressources naturelles Canada et de la Nunavut Tunngavik Incorporated. La bibliothèque physique est maintenue par Relations Couronne-Autochtones et Affaires du Nord Canada. La base de données incorpore des informations sur les emplacements des trous de forage et certains paramètres afférant aux forages et est constituée de façon à en permettre la présentation dans un format de navigation convivial et interactif. L'objectif principal du projet est de soutenir l'exploration minérale en rendant les données plus facilement disponibles et utilisables. C'est un produit à valeur ajoutée qui utilise des informations géoscientifiques préexistantes.

Introduction

The Nunavut Assessment Drill Database (NADD) is a compilation of data from public-domain mineral-tenure as-

essment reports. The main products of NADD are a spreadsheet tabulation and interactive Keyhole Markup Language (KML) file containing geographic information and selected other parameters on drillholes reported from

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mineral exploration throughout Nunavut (and some adjacent portions of the Northwest Territories). Led and operated by the Northwest Territories & Nunavut Chamber of Mines, the project has been funded from 2018 to the end of 2019 by the Geo-Mapping for Energy and Minerals program of Natural Resources Canada. Successive data releases were made in March 2018, March 2019 and December 2019. The NADD represents a new approach to presenting public geoscience in a readily accessible and user-friendly format.

Early-stage mineral exploration typically includes the review and application of pre-existing information, the general process of ‘data mining’. The NADD seeks to stimulate and streamline this process and increase the efficiency of mineral-exploration efforts by providing an easy gateway to opportunities that might otherwise be overlooked.

The NADD presents selected data from the assessment reports that mineral-tenure holders must file in order to retain their holdings beyond the initial grant period. Since 1930, some 4000 such reports have been filed for claims and prospecting permits in Nunavut and are publicly available. With completion of the third phase of NADD, 1084 reports have been reviewed and drill data for 3806 holes have been extracted or generated. Many of these reports are rich in geoscience information that may be of great use to future exploration programs. Drilling reports have been selected as being particularly valuable sources of information, not only from the detailed geological descriptions in them but especially because of the results of various tests and analyses performed on drillcore or drill chips.

Drill results may not immediately reveal an economic mineral deposit, but they generate valid information that can later be applied to revised geological mapping, interpretations or methods, and can be combined with knowledge of changed economic conditions. Investment and effort in mineral exploration are driven by the external factors of commodity prices and market demand for different metals and materials. Ready access to prior data will allow rapid benefit from those external changes. Recent examples are exploration for rare-earth minerals or for cobalt, both of which might have been identified in anomalous levels by previous work seeking some other commodity.

Although the focus is primarily on mineral exploration, NADD is foreseen to have other potential applications, including public awareness, community engagement and land-use monitoring. A significant problem in applying past drill data is the diversity of geographic co-ordinate systems used in various reports.

Data compilation processes

Assessment reports were generally viewed as PDF files, either downloaded from NUMIN (<http://nunavutgeoscience.ca/>

pages/en/numin.html) or obtained directly from the offices and library of the Minerals Division of Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) in Iqaluit. Text and tables in the reports were systematically reviewed for drillhole information and methodology. Some reports, particularly more recent ones, contain digital data in spreadsheet- or database-extract formats that was readily copied electronically. A spreadsheet was compiled by entering data on the following parameters for each hole:

- **Hole ID, Drill Type** (generally either core or reverse-circulation) and **Hole Size** (in industry-standard codes or diameter in numerical units, if so reported)
- **Assessment Report ID** – the unique numerical report identifier assigned by CIRNAC (or its predecessors) for each report submitted
- **Year Drilled, Year Reported and Reporting Operator**
- **Projection** (geographic location system), Universal Transverse Mercator (UTM) Easting and Northing, **Latitude** and **Longitude** (either as reported or as calculated during compilation), **Elevation** (not systematically entered but included as a data field to make it more fully compatible with typical X-Y-Z spatial databases) and **Location Method** (the means by which drillholes were sited on the ground, if reported, or the method used during compilation to assign a geographic location)
- **NTS map** (1:50 000 scale map of the Canadian National Topographic System (NTS) that contains the drill collar) and **Region of Nunavut** (Kitikmeot, Kivalliq or Qikiqtaaluk)
- **Azimuth, Reference Azimuth, Inclination and Length** – the basic parameters compiled from drill summary tables or from log sheets; Reference Azimuth (True North, UTM North or Local Grid) is commonly not stated in the reports or logs; Azimuth and Inclination (‘Dip’) are the initial orientations at the drill collar; Hole Length has been converted from feet to metres where necessary
- **Geology Log, Geotechnical Log** – have ‘Yes’ or ‘No’ entered to identify whether that information is included in the assessment report
- **Samples / Analyses** – populated in NADD 1.0 with a simple ‘Yes / No’ option, but has been upgraded to include more detailed information on samples extracted for testing and analysis, such as Microdiamonds, Geochemistry (broad suite), Geochemistry (select suite) and others
- **Geophysical or Physical Property tests**, such as downhole instrumentation logs or in situ tests (e.g., magnetic susceptibility, scintillometer or downhole radiometrics)
- **Commodity or commodities** – main minerals or materials sought during the reported exploration efforts

Most drillholes are reported in UTM co-ordinates or are displayed on drill-location maps that can be georeferenced in a UTM system. These co-ordinates were imported in batches as point data to the geographic information system program QGIS (QGIS Development Team, 2019) and then exported to the final database compilation in latitude and longitude using the WGS 84 datum. Less frequently, drill locations were reported directly or scaled from maps using latitude and longitude. The overall process puts drillholes into a uniform geographic co-ordinate system, making standardization of geographic co-ordinates one of the main achievements of NADD.

Limitations and uncertainties

A significant data gap is acknowledged in that some mineral-exploration drilling is never filed for assessment credit. The reported work available for capture by NADD is only a subset of the total amount of drilling performed.

As compilation proceeds back in time through the mid-1990s, GPS data will become less commonly available and determinations of drill locations will become more time consuming and likely less accurate. Some assessment reports present drill locations in generalized areas only, in local grid co-ordinates or on maps of various scales that are not always easily georeferenced. In these instances, numerical co-ordinates are measured or estimated from the best available information. With the maps provided being various scales, some of the calculated locations are only approximate, possibly with uncertainties greater than 1000 m. At larger scales (i.e., finer detail), the datum is commonly not specified when locations are given in latitude and longitude, leading to possible errors of a few metres when the positions are presumed to be in WGS 84.

If the compilation extends back beyond the early 1990s, geochemical analyses for broad element suites will be less common, meaning that older reports will tend to have smaller amounts of information of the sort that can lead to serendipitous finds. Generally, incorporating older reports will have a decreased cost-benefit balance as the process becomes more time consuming and the information gathered and generated is of lesser utility.

Products

The core products of NADD are a spreadsheet compilation and an interactive KML file. The current version, NADD 3.0, is available for download from the Northwest Territories & Nunavut Chamber of Mines website (<http://www.miningnorth.com/resources>) under the 'Geoscience' menu, and contains data gathered from 3806 drillholes.

The primary data files are a spreadsheet in Microsoft Excel® format and a slightly simplified comma-separated file. The main interactive product for client use is a single KML file (Google Developers, 2019), which can be opened in

Google Earth™, thus allowing panning, zooming and selection in order to view the compiled and calculated drill data. Selection in the browser of any individual drillhole location shows the data in a fly-out display on screen (Figure 1).

The detailed information now available in the 'Assays/Analyses' field will potentially allow NADD to evolve to a database that is searchable and sortable by the types of analyses performed. Although NADD is not primarily or exclusively a geochemical database, the multi-element geochemical analyses in these reports will perhaps be the most widely used data type in the compilation.

The NADD is not intended to reproduce or replace the information in assessment reports. Rather, it is a screening tool to identify assessment reports that may contain applicable material and presents data objectively without interpretation. Users are directed to the original assessment reports to retrieve information that might be applicable to their projects.

Drill-data overview

Basic statistics on the annual number of mineral-exploration drillholes and the total metreage drilled may be valid measures of economic activity and interest in the mineral-exploration industry, as filing the work in assessment reports represents the intent of project operators to retain tenures and continue exploration. Figure 2 tracks the annual number of holes drilled and total metreage, as recorded in Nunavut assessment reports and captured in NADD, and compares that information to broader measures of mineral exploration and development in Nunavut developed by Natural Resources Canada (<https://sead.nrcan-rncan.gc.ca/expl-expl/prelim-eng.aspx>) and reported by the Northwest Territories & Nunavut Chamber of Mines (2019). Drill programs after approximately 2014 are not fully reported in NADD 3.0, as the recent assessment reports had not yet been completely filed and reviewed, and had not passed through a period of confidentiality at the time of compilation. The comparisons show strong correlation for the two different methods of measuring mineral-exploration activity.

Economic considerations

A healthy and expanded minerals industry is widely acknowledged as beneficial and even necessary for short- and long-term economic development in Nunavut. The NADD supports this general goal, as the primary motivation for its development is to enhance the efficiency and cost effectiveness of mineral exploration, particularly early-stage work. The continued importance of grass-roots exploration (e.g., Dover, 2018) is recognized and supported by products like NADD. Prospectors' education and training offered by the Government of Nunavut Department of Economic Devel-



Figure 1: Screen capture image generated using Google Earth Pro under the Google™ terms of use (<https://www.google.com/permissions/geoguidelines/>), showing the full distribution of drillholes in NADD 3.0 across Nunavut and the fly-out information label for one selected drillhole in the Belcher Islands. Earth imagery ©2018 Google; map data sources: Google, U.S. Geological Survey, Landsat / Copernicus, International Bathymetric Chart of the Arctic Ocean.

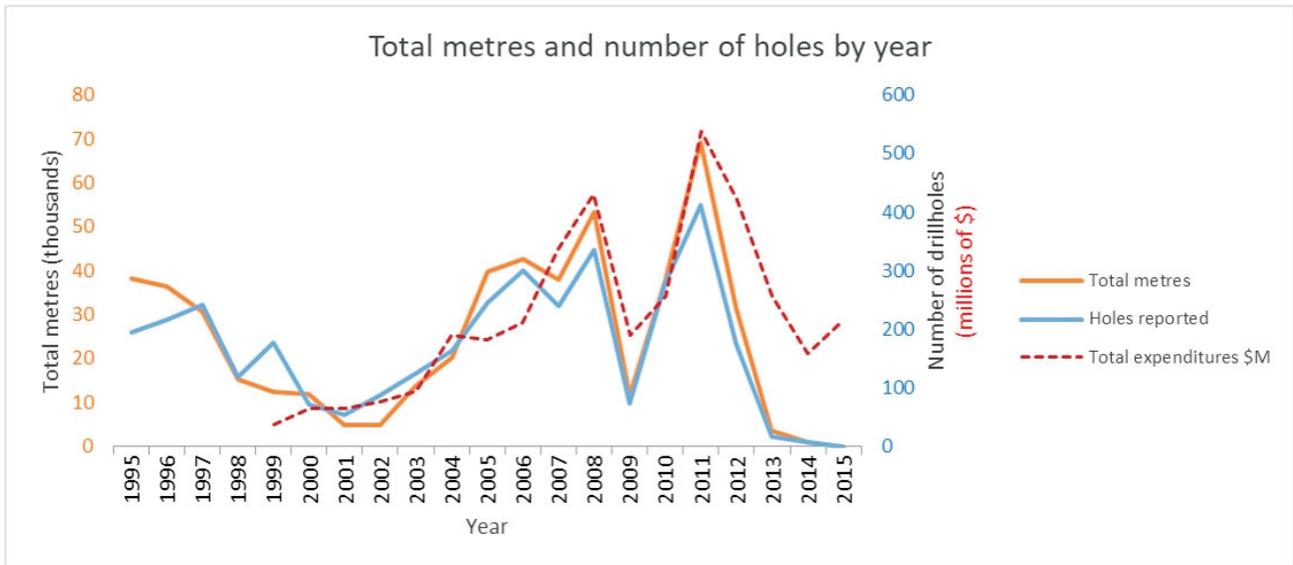


Figure 2: Annual number of drillholes reported for tenure assessment (and total metres of drilling) in Nunavut, as compiled in NADD 3.0, and mineral-exploration expenditures estimated by the annual surveys of Natural Resources Canada (<http://sead.nrcan.gc.ca/expl-expl/prelim-eng.aspx>) and reported by the Northwest Territories & Nunavut Chamber of Mines (2019).

opment and Transportation (<https://gov.nu.ca/economic-development-and-transportation/programs-services/nunavut-prospectors-program-npp>) aids the participation of northern residents, and NADD will be a complementary tool that helps put small operators or individuals on a more level playing field with larger, established mineral-exploration companies.

Future work

The current status of NADD is seen by its producers as a seed project that might spur the creation of similar value-added products capable of yielding additional economic and social benefit from public-domain geoscience data. To increase the accessibility and utilization of public-domain information from assessment reports, one possibility would be to create a georeferenced file containing the pre-existing report metadata that already exists in the NUMIN electronic library.

Expansion of the current drill dataset is also recommended, although the diminishing returns noted above for extracting information from older reports should be considered before finite resources are allocated. The database could be expanded to include drilling information within reports that are filed for land-use permitting but not for mineral-tenure assessment.

To effectively cover the very large landmass of Nunavut, ground-based exploration alone is unlikely to serve economic policy goals and the needs of industry. Ideally, in future, focused products like NADD can be integrated with other data applications such as remote sensing.

Conclusions

The developers of NADD anticipate that the database will serve as a useful tool to aid mineral exploration. The database incorporates information on drillhole locations and selected drilling parameters, and presents them in an interactive, user-friendly, browsable format. It is a 'data mining' product that enhances the accessibility and utilization of

pre-existing geoscience information, and is a pioneer in this field within Nunavut. For the relatively low cost of its development and production, NADD can make a high-value contribution to public geoscience.

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References

- Dover, M. 2018: The vanishing breed; *Up Here Business*, v. 8, p. 64–69.
- Google Developers 2019: KML documentation introduction; Google Developers, URL <<https://developers.google.com/kml/documentation/>> [November 2019].
- Northwest Territories & Nunavut Chamber of Mines 2019: Economic outlook good for Nunavut and Yukon, but not NWT; Northwest Territories & Nunavut Chamber of Mines, Chamber News <URL <http://www.miningnorth.com/chamber-news/102025>> [January 2020].
- QGIS Development Team (2019): QGIS Geographic Information System; Open Source Geospatial Foundation Project, URL <<http://qgis.osgeo.org>> [October 2019].

