



# Maximizing the value of historical bedrock field observations: An example from northwest Canada



Karen M. Fallas\*, Robert B. MacNaughton, Matthew J. Sommers<sup>1</sup>

Geological Survey of Canada, Natural Resources Canada, 3303-33rd Street NW, Calgary, AB T2L 2A7, Canada

## ARTICLE INFO

### Article history:

Received 1 October 2014

Revised 22 January 2015

Accepted 23 January 2015

Available online 14 March 2015

### Keywords:

Data rescue

Bedrock mapping

Historical data

GIS data

Operation Norman

Canada

## ABSTRACT

Historical bedrock field observations have potential for significant value to the scientific community and the public if they can be rescued from physical records stored in archives of scientific research institutions. A set of historical records from 'Operation Norman', a bedrock mapping activity conducted in northwestern Canada by the Geological Survey of Canada (GSC) from 1968 to 1970, was identified as suitable for data rescue and incorporation into a GIS geodatabase. These observational data, including field stations, lithology descriptions, structural measurements, measured section locations, and fossil localities, were digitized as geospatial features with attributes assigned according to the observation records. Over 90% of the original observations were successfully rescued in this manner, allowing for effective incorporation with newer observations. Lack of reliable location information for field observations was the primary impediment to effective data rescue. Access to original participants in Operation Norman was particularly helpful in ensuring successful data rescue, as was the excellent state in which research materials had been curated. The resulting dataset of combined historical and recent observations provides improved distribution of observations to constrain geological analysis and map interpretation. Rescued data from Operation Norman have been incorporated in new bedrock map compilations and other scientific publications.

Crown Copyright © 2015 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

Since its founding in 1842, the Geological Survey of Canada (GSC) has been Canada's main federal government agency for geoscience surveys, research, and information, and has accumulated an immense amount of information about the Canadian landmass. Current objectives of the GSC emphasize the importance of providing public geoscience knowledge. In its most recent formulation [1; p. 2], the GSC's mission is to "[p]rovide public geoscience knowledge to sustain the exploration effectiveness and international competitiveness of the mineral and energy sectors, inform the stewardship of [Canada's] onshore and offshore lands, and increase the safety and security of Canadians". This emphasis on the provision of public data is in keeping with the recent Government of Canada Open Data initiative (see <http://data.gc.ca/eng/open-data>). However, although much GSC data and information is available publicly in hardcopy and digital publication formats, many of the

original observation records remain in GSC archives where they are relatively inaccessible to the public. This is particularly true of data from historical field studies.

There are two key principals of open data initiatives that strongly encourage data rescue efforts: completeness and machine readability (see <http://data.gc.ca/eng/open-data-principles>). Indeed, both principles are explicitly referenced in a commonly used definition of data rescue (emphasis added): "an ongoing process of **preserving all data** at risk of being lost due to deterioration of the medium, and the digitizing of current and past data into **computer-compatible form for easy access**" [2]. Traditional, hardcopy bedrock maps published by the GSC fulfill neither of these principles. Although such maps were based on extensive field observations, only an incomplete subset of data could be displayed on the published map or included in an accompanying report. Hardcopy data and information, such as that preserved for many historical GSC research activities, is not machine readable and thus is of sub-optimal value because the data and interpretations are not easily integrated with other data sources for continued research. The push to make data and interpretations more widely available in usable formats has encouraged the GSC to modernize its data collection and map delivery techniques, including strategies for incorporating

\* Corresponding author. Tel.: +1 403 292 7004.

E-mail addresses: [Karen.Fallas@NRCan-RNCan.gc.ca](mailto:Karen.Fallas@NRCan-RNCan.gc.ca) (K.M. Fallas), [Robert.MacNaughton@NRCan-RNCan.gc.ca](mailto:Robert.MacNaughton@NRCan-RNCan.gc.ca) (R.B. MacNaughton), [Matthew.Sommers@NRCan-RNCan.gc.ca](mailto:Matthew.Sommers@NRCan-RNCan.gc.ca) (M.J. Sommers).

<sup>1</sup> Present address: #202, 1917-24A Street SW, Calgary, AB T3E 1V4, Canada.

historical data—for the sake of completeness—into new publications in modern, machine-readable formats.

This paper describes an effort to rescue archived data from Operation Norman, a GSC bedrock-mapping program carried out between 1968 and 1970. Although these data were well organized and relatively safe from loss, the data rescue mission we describe has given them a second life in the public domain and improved their analytical value by reproducing them in modern GIS format.

## 2. Historical background

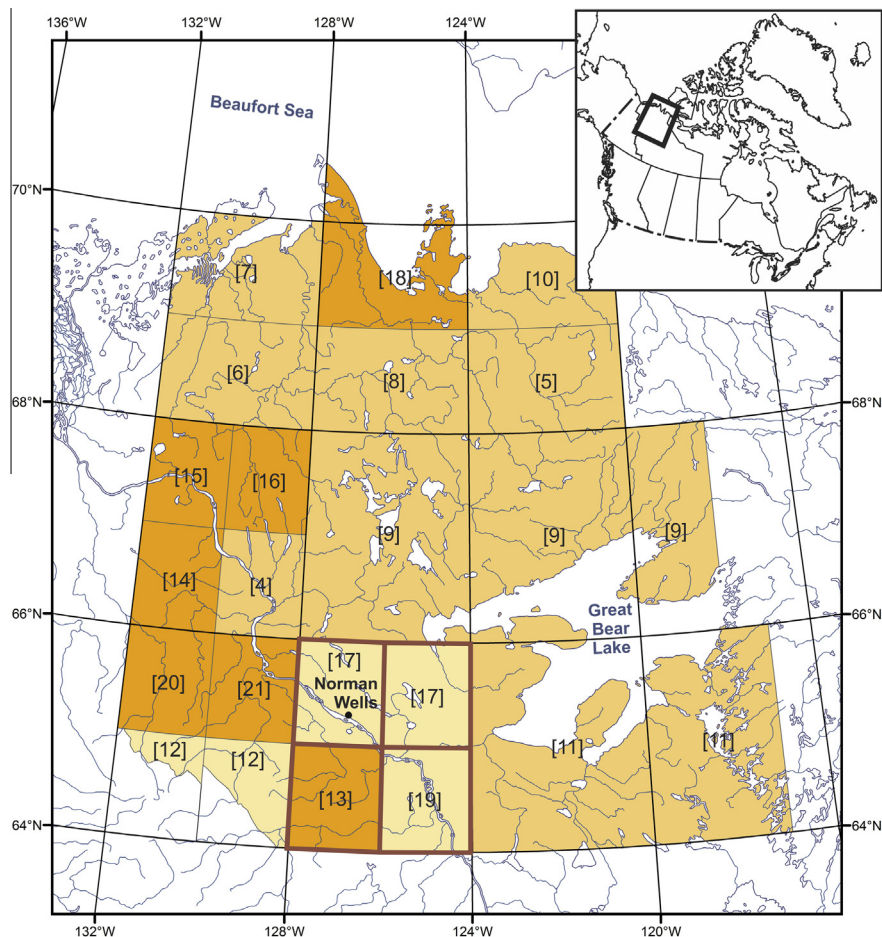
### 2.1. Operation Norman (1968–1970)

In 1952, the GSC began to use helicopters in support of its bedrock mapping activities. This resulted in a series of regionally extensive reconnaissance operations, each named for the geographic region in which it was undertaken [3]. By the late 1960s, only one large sedimentary terrain remained in Canada that lacked geological map coverage at 1:500,000 scale. This was a region of about 375,000 km<sup>2</sup> on Canada's northern mainland (Fig. 1), delineated by a southern boundary at 64° N, a western boundary at 132° W, a northern boundary at the shore of the Arctic Ocean, and an eastern boundary defined by the contact between Paleozoic strata of the Interior Platform and underlying Precambrian rocks of the Canadian Shield [22]. It encompassed parts of the Mackenzie

Mountains, Mackenzie Plain (including the long-producing oil field at Norman Wells), Franklin Mountains, and Interior Plains. Operation Norman was undertaken to address this lack, and was staffed mainly by scientists from the GSC's Calgary office.

Primary field operations for Operation Norman were carried out during the summer field seasons of 1968, 1969, and 1970, and included bedrock mapping, stratigraphic studies, and investigation of surficial deposits [23–25]. Bedrock mapping was done at reconnaissance scale, using standardized field-note forms, cross-referenced to localities marked on aerial photographs and/or topographic maps (Fig. 2).

Following map compilation, bedrock maps were published in a variety of formats (Fig. 1), at scales dictated by the level of geological detail [23]. Some, e.g. [13,20,21] were prepared to the standard of what were termed “A series” maps—multicoloured, professionally drafted and edited maps that presented “an author's considered conclusions on the geology of an area” [26, p. 1]. These maps were published at 1:250,000 scale, and some were issued with accompanying “Memoirs”, a publication series that was intended to present comprehensive final reports on the geology of specific areas [26]. Memoirs, at minimum, included detailed information on the character of and variation within geological units, as well the structural geology of the study area, e.g. [27]. Maps compiled at 1:500,000 scale generally were published as “Preliminary Maps”, which were professionally drafted and incorporated colour line-work but did not utilize



**Fig. 1.** Location map. Coloured area on main map is the region covered by Operation Norman (1968–1970); dark orange areas were published as GSC A-series maps, medium orange areas as GSC Preliminary maps, and light orange as GSC Open File maps (see Section 2.1). Numbers correspond to Operation Norman map publications [4–21]; see reference list. Map areas with heavy dark orange outline were included in the data rescue activity documented in this paper. Inset shows position of detailed map in northwestern Canada. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Download English Version:

<https://daneshyari.com/en/article/4674440>

Download Persian Version:

<https://daneshyari.com/article/4674440>

[Daneshyari.com](https://daneshyari.com)