

# GROUNDWATER RESOURCES STUDY (GRS) 19 METADATA

## GENERAL INFORMATION

### Title

A Three-Dimensional Geological Model of the Paleozoic Bedrock of Southern Ontario

**Alternate Title:** GRS019

**Date of Publication:** 26 November 2019

### Abstract

Carter, T.R., Brunton, F.R., Clark, J.K., Fortner, L., Freckelton, C., Logan, C.E., Russell, H.A.J., Somers, M., Sutherland, L., Yeung, K.H. (authors)

This publication can be downloaded from GeologyOntario: see Distribution Information section.

A regional three-dimensional (3-D) lithostratigraphic model of the Paleozoic bedrock of southern Ontario has been completed. The model encompasses the entire Phanerozoic succession of southern Ontario (110,000 square kilometres), consisting of over 1500 m of sedimentary strata straddling regional arch, or forebulge, zones separating the Appalachian foreland basin from the Michigan structural basin. This initiative provides an unprecedented regional 3-D perspective and digital framework based on an updated regional lithostratigraphic chart. Constructed using Leapfrog® Works, an implicit modelling software application, the model format can readily support numeric groundwater-flow modelling.

Fifty-four Paleozoic bedrock layers representing 70 formations, as well as the Precambrian basement and overlying unconsolidated sediment, were modelled at a spatial resolution of 400 m. Borehole records in Ontario's public petroleum well database (Ontario Petroleum Data System (OPDS)) were the principal data source, supplemented by Ontario Geological Survey (OGS) deep boreholes, measured sections, control points and Michigan boreholes. A newly revised digital bedrock topography surface combined with revised subcrop geology and digitized 3-D surface polyline and point constraints were used to better align the modelled layers and their extrapolation to the subcrop surface. Model development was an iterative cycle of interim modelling, expert geological appraisal, and quality assurance and control (QA/QC) editing of geological data using geophysical logs, drill cuttings and core, supplemented by manual editing of model layers. The 3-D model provides a robust representation of regional bedrock geology.

A properly constructed borehole database and its supporting information is an essential requirement for construction of a 3-D model, but data errors, inconsistencies, data gaps, location errors, etc. can compromise the reliability of the model. From 2015 to 2018, project geologists and geological contract staff of the Oil, Gas and Salt Resources Library completed edits to 30 320 formation tops in a total of 7812 wells, resulting in a revised data set and permanent improvements to the petroleum well database. This report highlights the importance of QA/QC of well data, specifically formation top identification, and summarizes the data improvements made in support of the present 3-D model. No seismic data was available.

Additional information and metadata are found within a readme file provided with the product.

## **Purpose or Objective**

In 2015, the Geological Survey of Canada (GSC) and Ontario Geological Survey (OGS) initiated a project to develop a three-dimensional (3-D) geological model of the Paleozoic bedrock geology of southern Ontario as part of a collaborative initiative to advance knowledge of regional groundwater geoscience in Ontario. This work was completed in collaboration with the Ontario Ministry of Natural Resources and Forestry (MNRF) and the Oil, Gas and Salt Resources Library, London, Ontario (OGSRL). The resultant 3-D geological model is the first to include all of the Paleozoic stratigraphy of southwestern and south-central Ontario. A parallel project to model the geology and hydrogeology of the overlying unconsolidated surficial sediment is also underway.

The study is focussed on the development of a 3-D bedrock lithostratigraphic model of the region. This model is an integration of previous and ongoing stratigraphic–sedimentologic studies and relevant geological data that define sedimentological (facies) and structural features. The model delineates the geological controls on the occurrence and movement of water within the bedrock formations of southern Ontario and is a necessary precursor for the development of a planned hydrostratigraphic model.

The report in the GRS documents iterative geological model development, data sources, quality assurance and control (QA/QC), and plans for model delivery and applications. Information presented in previous reports and presentations are superseded by this document. It is supported by and complementary to, recent reports on QA/QC, data capture, construction of an updated lithostratigraphic chart, and hydrochemical groundwater regimes.

The objective of this product is to collect and disseminate geoscience information for Ontario.

## **Keywords:**

Geological Survey  
Geology  
Ministry of Energy, Northern Development and Mines  
ENDM  
Ministry of Northern Development and Mines  
MNDM  
Ontario Geological Survey  
OGS  
Groundwater Resources Study  
GRS  
Stratigraphy  
Paleozoic Bedrock Geology  
Stratigraphy  
Subsurface Bedrock Geology  
Sedimentology  
3-D Modelling  
Groundwater

## **Business Theme:**

Geological Survey  
Geology

## GEOGRAPHIC INFORMATION

### Geographic bounding box

North bounding latitude: 45° 13.7'  
West bounding longitude: -83° 07.4'  
East bounding longitude: -76° 49.5'  
South bounding latitude: 41° 47.1'

### Geographic bounding box

North bounding latitude: 45.2289°  
West bounding longitude: -83.1239°  
East bounding longitude: -76.8257°  
South bounding latitude: 41.7850°

**Description of Completeness:** irregularly shaped study area - completeness not available

## MAPPING INFORMATION

<b>Grid Coordinate System Used</b>	Universal Transverse Mercator
<b>Map Projection</b>	Transverse Mercator
<b>Horizontal Geodetic Datum</b>	NAD83
<b>Vertical Datum</b>	EGM96
<b>Horizontal Position Accuracy of Features:</b>	Unknown
<b>Vertical Position Accuracy of Features:</b>	Unknown

## DATA SOURCE INFORMATION

### Data Source Type and Description:

Includes Bibliographic Information: Product includes references to other sources of information

### Data Source Type and Description:

Direct Field Collection: Work on data and model conducted from 2015 to 2019

### Data Source Type and Description:

Other Data Sets: Product includes references to other data sets used as sources of information

**Current Status of the Data Set:** Complete

**Frequency of Changes or Additions to be made to the Data Set:** Not Planned

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Carter, T.R., Brunton, F.R., Clark, J.K., Fortner, L., Freckelton, C., Logan, C.E., Russell, H.A.J., Somers, M., Sutherland, L. and Yeung, K.H. 2019. A three-dimensional geological model of the Paleozoic bedrock of southern Ontario; Ontario Geological Survey, Groundwater Resources Study 19 / Geological Survey of Canada, Open File 8618. <https://doi.org/10.4095/315045>.

ISBN 978-1-4868-3944-5 (DVD) ISBN 978-1-4868-3945-2 (zip file)

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**The Language in which Data are Distributed:** English

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## **METADATA**

**Date of this Metadata Description/Update:** November 18, 2019