

Geological map of Québec

2012 Edition

Robert Thériault and Stéphane Beauséjour

DV 2012-07

Québec

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Direction générale

Robert Giguère (par intérim)

Direction de l'information géologique du Québec

Luc Charbonneau (par intérim)

Geological compilation

Robert Thériault

Technical drafting

Stéphane Beauséjour

Editing

Joanne Nadeau

Graphics

André Tremblay

Landsat photo

Direction générale de l'information géographique

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Robert Thériault and Stéphane Beauséjour (MRN)

Abstract

This document contains a new geological map of Québec at a scale of 1:2 000 000 produced by the *ministère des Ressources naturelles* (MRN) during the last year. This new map, an update of the 2002 edition, was produced in order to incorporate the results of the numerous geological mapping projects carried out throughout the Province of Québec during the last ten years. The digital map is viewable and searchable through the ArcGIS platform. Furthermore, an interactive map is distributed on Internet, and enables to put in relation geological (e.g. stratigraphic unit, mineral deposit, drill hole) and geographical (e.g. satellite imagery, hydrography, topography) information. The new geological map of Québec will serve as a promotional tool for the diffusion of the geological knowledge of the territory of Québec, for the benefit of school, college and university institutions, research centers and the general public, among others.

Compared with the previous version published in 2002, the new geological map of Québec contains the following features:

- The level of detail of the geology increased significantly, as reflected in the increase in the number of units making up the geological legend, which went from 106 to 165, as well as the number of geologic zones (i.e. polygonal elements), which is in the order of about 6500 relative to 4400 for the previous version;
- In addition to including the age and lithological description, the ArcGIS database attached to the geological map now includes the stratigraphic unit of the digitized geologic zones. Thus, over 900 different stratigraphic units are present in the database;
- A box in a corner of the map presents, in addition to the limits of the geological provinces, a subdivision at the level of subprovince, zone, belt and orogen.

INTRODUCTION

This document contains a new geological map of Québec at a scale of 1:2 000 000 produced by the *ministère des Ressources naturelles* (MRN) during the last year. This new map, an update of the 2002 edition, was produced in order to incorporate the results of the numerous geological mapping projects carried out throughout the Province of Québec during the last ten years. The new geological map of Québec will serve as a promotional tool for the diffusion of the geological knowledge of the territory of Québec, for the benefit of school, college and university institutions, research centers and the general public, among others.

NEW FEATURES OF THE 2012 EDITION

Compared with the previous version published in 2002, the new geological map of Québec contains the following new features:

1. The level of detail of the geology increased significantly, as reflected in the increase in the number of units making up the geological legend, which went from 106 to 165 (56 % increase), as well as the number of geologic zones (i.e. polygonal elements), which is in the order of 6466 relative to 4408 for the previous version (47 % increase).
2. The main diabase and gabbro dykes are not represented on the new map because they are too narrow to appear at a scale of 1:2 000 000.
3. The level of accuracy of the location of faults and geologic zones has been improved, as the compilation and drafting steps were digitally performed directly with ArcGIS, while these steps were carried out on paper in the previous version of the map.
4. In addition to the age and lithological description, the ArcGIS database attached to the geological map now includes the stratigraphic unit of the digitized geologic zones. Thus, a total of 917 different stratigraphic units are present in the database.
5. The labels identifying the geologic zones of the map are in alphanumeric format, with a letter representing the geological province (L : St. Lawrence Platform; H : Hudson Bay Platform; A : Appalachian Province; G : Grenville Province; C : Churchill Province; N : Nain Province; S : Superior Province), followed by a sequential number representing the chronological order of the units of each geological province. In the previous edition, the labels were simply in numeric format.
6. A box in the upper right corner of the map presents, in addition to the limits of the geological provinces, a subdivision at the level of subprovince, zone, belt and orogen.
7. A color graphic design was added along the edge of the map in order to enhance the aesthetic level.
8. The map data are available on WMS service.

METHODOLOGY

The new geological map of Québec was produced applying a specific and structured methodology that will facilitate future updates. Here is a technical description of the main steps of production of this geological map:

1. The compilation and drafting of the geologic zones and faults were digitally produced in ArcGIS using different layers of geological and geophysical information, predominantly the digital geological data of the *Système d'informations géominières* (SIGÉOM) of the MRN, as well as georeferenced, regional geological compilation maps and aeromagnetic data. During the drafting of the geologic zones, a control polygon of specific size was used as a reference point. Its dimension corresponded to the minimum size of a geologic zone that may appear on the map at a scale of 1:2 000 000.
2. The digitization of the geologic zones and faults in ArcGIS was performed by first copying on a layer the geologic zones traced during the previous compilation step, then applying smoothing tools having preset parameters in order to smooth and standardize the level of curvature of the outline of geologic zones and faults.
3. A centroid was then assigned to each of the digitized geologic zones, and was linked to a database that includes the corresponding unit of the geological legend, the geological era, the geological period, the stratigraphic unit, the geological description and the color code appearing on the map.
4. A color was assigned to each unit comprising the geological legend using the colorimetric chart (RVB code) of the SIGÉOM system. A total of 135 different colors were used to represent the 165 different geological units, including 35 new colors that were not originally present in the chart.

MAJOR GEOLOGICAL DIVISIONS OF QUÉBEC

The geology of Québec is divided into seven major divisions or geological provinces:

1. Superior Province
2. Nain Province
3. Churchill Province
4. Grenville Province
5. Appalachian Province
6. St. Lawrence Lowlands Platform
7. Hudson Bay Platform

The limits of these geological provinces are illustrated on the location map (see box) that accompany the geological map of Québec. Furthermore, subdivisions of these provinces are also presented at the level of subprovince, zone, belt and orogen.

Superior Province

The Superior Province (4.3 to 2.5 Ga) is an Archean craton that occupy the central part of the Canadian Shield. It covers about half of the surface area of Québec, or near 745 000 km². It is formed of Archean terrains unconformably overlain by Proterozoic and Paleozoic sedimentary rocks. The Superior Province is subdivided into seven subprovinces, which are, from north to south: the Minto, the Ashuanipi, the La Grande, the Opinaca, the Opatica, the Abitibi and the Pontiac (see box in the geological map).

The geology of the northern portion of the Superior Province (i.e. Minto Subprovince) was interpreted at a scale of 1:2 000 000 using the 1:500 000 scale compilation map produced following the Grand Nord mapping project carried out by the MRN during the early 2000s (Simard *et al.*, 2008). The geology of the Ashuanipi Subprovince was interpreted using a recent compilation map produced by the MRN at a scale of 1:250 000 that has yet to be published. The geological compilation of the other subprovinces located in the southern part of the Superior was carried out directly using the actual data present in the SIGÉOM system.

Nain Province

The Nain Province (3.8 to 1.3 Ga) is situated along the east coast of Labrador. In Québec, it is present in two different areas to the east of the Torngat Mountains, where it occupies a mere 60 km² in surface area. In these two areas, the Nain Province consists of Archean-aged gneissic rocks. The geological compilation was carried out using the data present in the SIGÉOM system.

Churchill Province

The Churchill Province (2.9 to 1.1 Ga) is located to the north and east of the Superior Province, and covers an area of near 200 000 km². It consists of an assemblage of cratonic blocks of Archean to Paleoproterozoic age that are bordered by the New Québec (to the west), Ungava (to the north) and Torngat (to the east) Paleoproterozoic orogens. The Core Zone (James *et al.*,

1996) is located between the New Québec and Torngat orogens. It contains Archean to Paleoproterozoic rocks injected by Mesoproterozoic plutonic rocks.

The geology of the northern part of the Churchill, which includes the Ungava Orogen, was interpreted using a 1:250 000 scale compilation map recently produced by the MRN (Lamothe and Simard, 2010). The compilation of other sectors of the Churchill Province was performed using data from the SIGÉOM system.

Grenville Province

The Grenville Province (2.7 to 0.6 Ga) covers approximately one third of the area of Québec, or near 500 000 km². It follows the southeastern limit of the Superior Province, and represents an orogenic belt formed of a package of varied lithologies, including, among other things, an important assemblage of high temperature intrusions (e.g. anorthosites, mangerites, charnockites). To the northwest, the Grenville Front marks the limit of Archean and Paleoproterozoic terrains that form the Parautochthon. At the southeastern limit of the Allochthon, the Grenville Province is unconformably overlain by Paleozoic sedimentary rocks belonging to the St. Lawrence Platform.

The geological compilation of the Grenville Province was carried out mainly from data contained within the SIGÉOM system. A 1:2 000 000 scale geological compilation map covering the entire Grenville Province and produced by the Geological Survey of Canada (Davidson, 1998), as well as a few 1:100 000 scale compilation maps produced by the Government of Newfoundland and Labrador in the area situated north of the Lower North Shore region (James and Nadeau, 2000, 2001a, 2001b, 2002a, 2002b; Wardle *et al.*, 2000), were also used for the interpretation.

Appalachian Province

The Appalachian Province (0.6 to 0.3 Ga) consists in large part of Paleozoic sedimentary rocks distributed along the southeast margin of the Canadian Shield. The Appalachians were affected in Québec by two main tectonic events, which are the Taconian and Acadian orogens. The Appalachians are bordered to the east by the Permo-Carboniferous Magdalen Basin.

The geology of the Appalachian Province was interpreted using the 1:250 000 scale compilation maps of the Lower St. Lawrence and Gaspésie (Brisebois and Nadeau, 2003) and Estrie-Beauce area (Slivitzky and St-Julien, 1987), as well as from data from the SIGÉOM system.

St. Lawrence Platform

The St. Lawrence Platform (0.5 to 0.4 Ga) is subdivided into two distinct platforms, which are the St. Lawrence Lowlands Platform and the Anticosti Platform. It is comprised of sedimentary rocks that formed during the Paleozoic following rifting of the supercontinent Rodinia and formation of the Iapetus Ocean. In the southern part of Québec, the Cretaceous-aged Monteregian Hills represent alkaline intrusions injected in rocks of the St. Lawrence Platform and Appalachians.

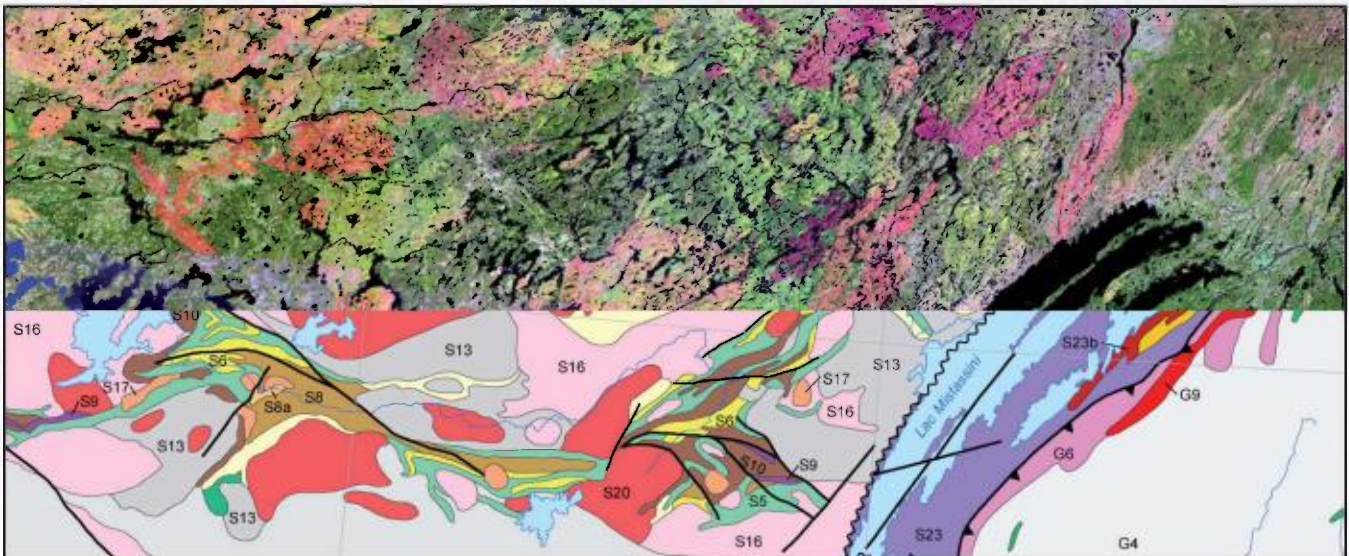
The geology of the St. Lawrence Lowlands Platform was interpreted using a 1:250 000 scale compilation map produced by the MRN (Globensky, 1987), whereas data from the SIGÉOM system served for the geological compilation of the Anticosti Platform.

Hudson Bay Platform

The Hudson Bay Platform (0.45 to 0.40 Ga) covers an area of approximately 5400 km² located just to the south of James Bay. It consists of Paleozoic sedimentary rocks having a similar composition than those forming the St. Lawrence Platform. The geological compilation was produced directly from the data of the SIGÉOM system.

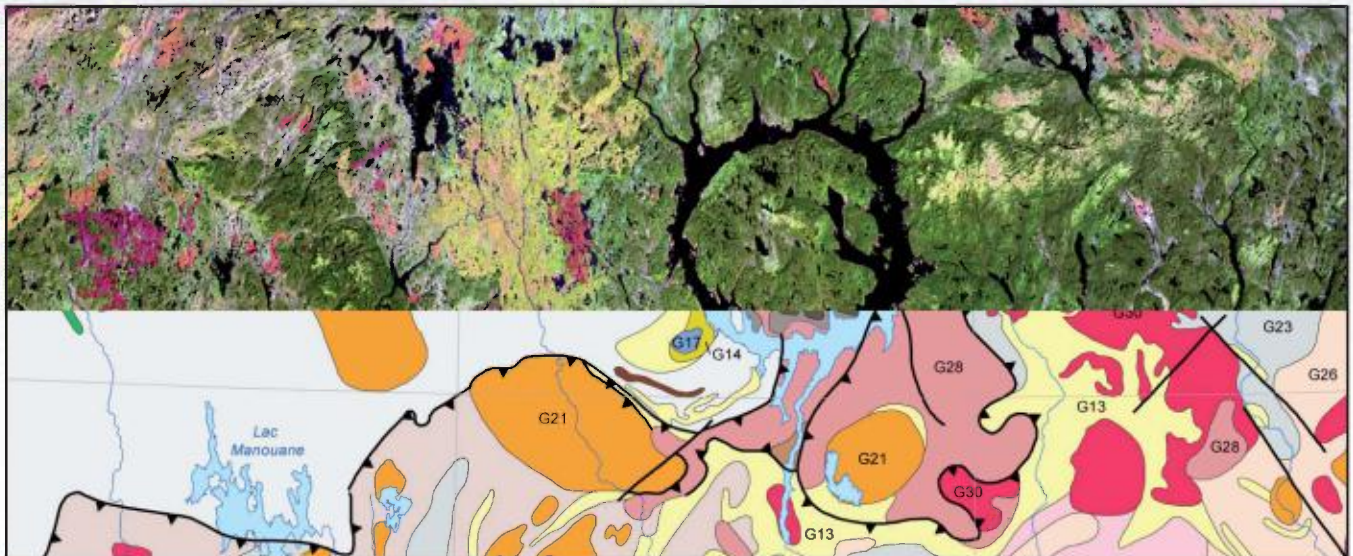
COLLABORATORS

This new edition of the geological map of Québec was produced through the collaboration of a number of people from Géologie Québec. In particular, the edition of the geological content of the map and legend was carried out by geologists who specialize in a specific geological province, that is Jean Goutier for the Superior (James Bay, Abitibi and Pontiac), Martin Simard for the Superior (Grand Nord and Ashuanipi) and the Churchill (Core Zone), Abdelali Moukhsil for the Grenville, Daniel Lamothe for the Churchill (Ungava) and Tom Clark also for the Churchill (New-Québec). Finally, Ghyslain Roy, Caroline Thorn and Claude Guérin, members of the monitoring committee, collaborated on different aspects of the geological map throughout the project.



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