

# Chapter 1. Introduction to Canadian Geology

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<https://openpress.usask.ca/geolmanual/part/main-body/>

## 1.1 INTRODUCTION

Welcome to your physical geology labs! In your first lab, we'll introduce you to Canadian geology and mineral and energy resources across the country.

The objective of this lab to gain an appreciation of the types of mineral and energy resources in Canada and the mineral and energy resources in your province or territory. We will explore how these mineral and energy resources relate to the patterns in the geology and rock ages in your province or territory.

### 1.1.1 Learning Outcomes

After completing this chapter, you should be able to:

- name several mineral and/or energy resources found across Canada
- describe generally where these resources are found in Canada
- describe how these resources relate to the geology of Canada
- name mineral and/or energy resources found in your province or territory
- describe how these resources are distributed across your province or territory
- describe how these resources relate to the geology in your province or territory

### 1.1.2 Key Terms

- mineral resources
- energy resources
- geological units
- bedrock geological map
- mineral resource map
- Interior Platform
- Eon
- Precambrian
- Phanerozoic
- geological provinces
- Canadian Shield

# Overview of Canadian Geology and Mineral and Energy Resources

<https://openpress.usask.ca/geolmanual/chapter/overview-of-canadian-geology/>

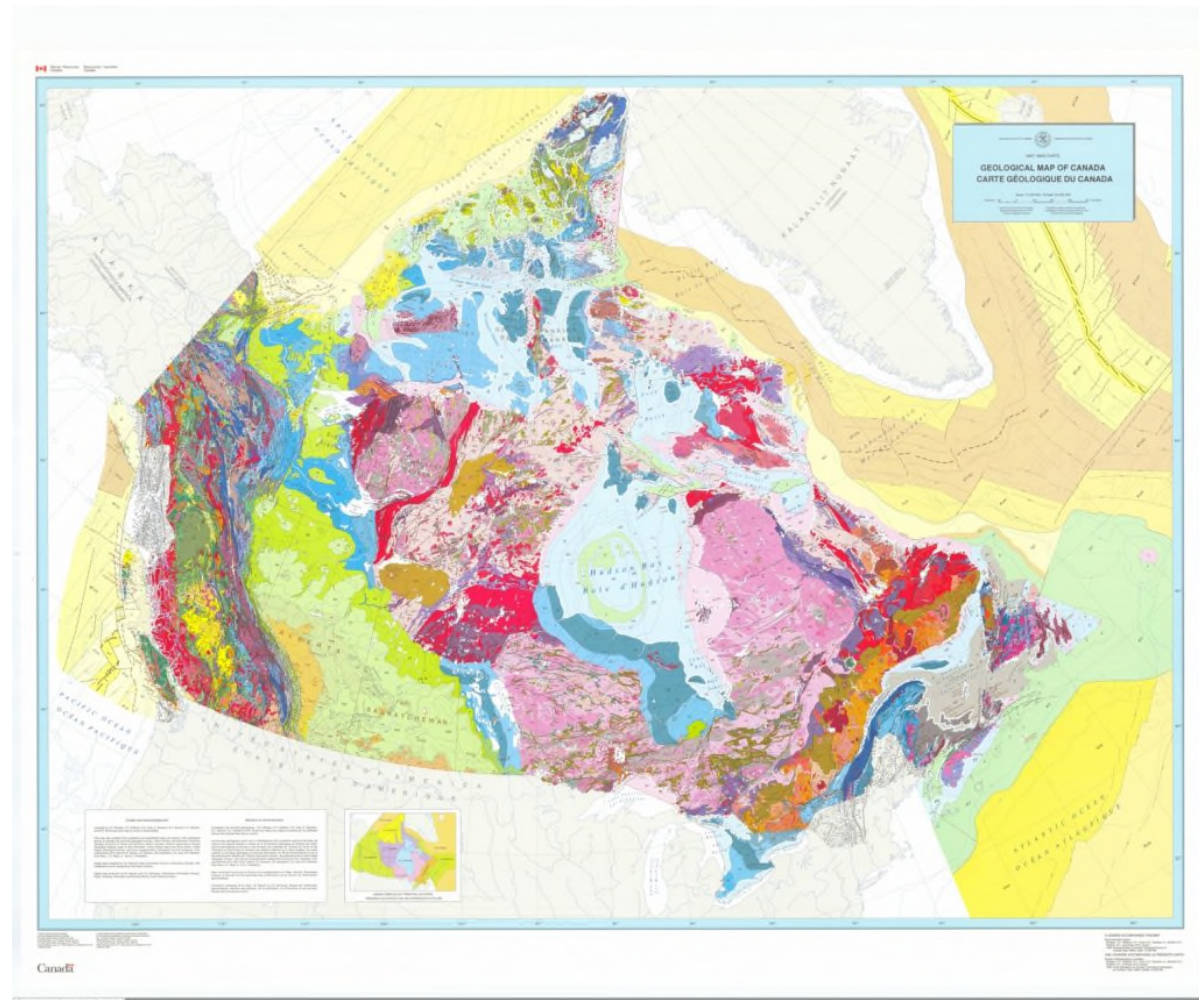
Note: this chapter is structured with a brief introduction to general Canadian geology and mineral and energy resources, and then specific information for each province or territory of the country. If you are a student, please read the section for the province or territory where you are going to university first. Please answer the questions in the exercises section of this chapter based on the province or territory where you are attending university.

## 1.2 CANADIAN GEOLOGY & RESOURCES

The geology of Canada is very diverse (Figure 1.1). In Alberta, Saskatchewan and Manitoba, the prairies are flat because the rocks beneath are flat-lying sedimentary rocks deposited from an inland sea many millennia ago. In mountainous BC and the Yukon Territory, there are volcanoes resulting from plates colliding along the west coast of North America. The iconic beauty of the majestic Rocky Mountains grace BC and Alberta; these rocks are composed of uplifted sedimentary rocks that used to be at the bottom of the ocean. The rocks of the Canadian Shield are the base for the stunning lakes and rocky landscapes of the Northwest Territories, Nunavut, Manitoba, Ontario, and Quebec and represent some of the oldest rocks on Earth and the core of the North American continent. When these rocks formed, the landscape would have appeared much like the Hawaiian Islands today - but it was before plant life evolved! The Appalachian Mountains through southern Quebec used to be as high as the Rockies but have worn away over the many millions of years since they formed. On the East coast, rocks with some of the oldest multicellular fossils in the world jut out from the coast of Newfoundland, and thick layers of sediments coat the continental shelf that extends underwater out into the Atlantic Ocean.

This broadly varying geology has generated diverse and plentiful mineral and energy resources across our country. **Mineral resources** include: metals such as gold, silver, and copper; minerals such as diamonds and gypsum; and quarried building materials such as gravel, sand, and limestone. **Energy resources** include oil, gas, and coal deposits. Examples of mineral and energy resources in Canada include the oil and gas deposits of the prairies of Alberta and Saskatchewan and the base metal (e.g., nickel, lead, copper) mines in BC, the Yukon, Ontario, and Quebec. Some of the geology that hosts these resources is special and unusual, for example the nickel deposits mined at Sudbury, ON were formed from an ancient meteorite impact. Other geology is relatively

common, for example sand and gravel are mined at quarries across the country for use in building materials.



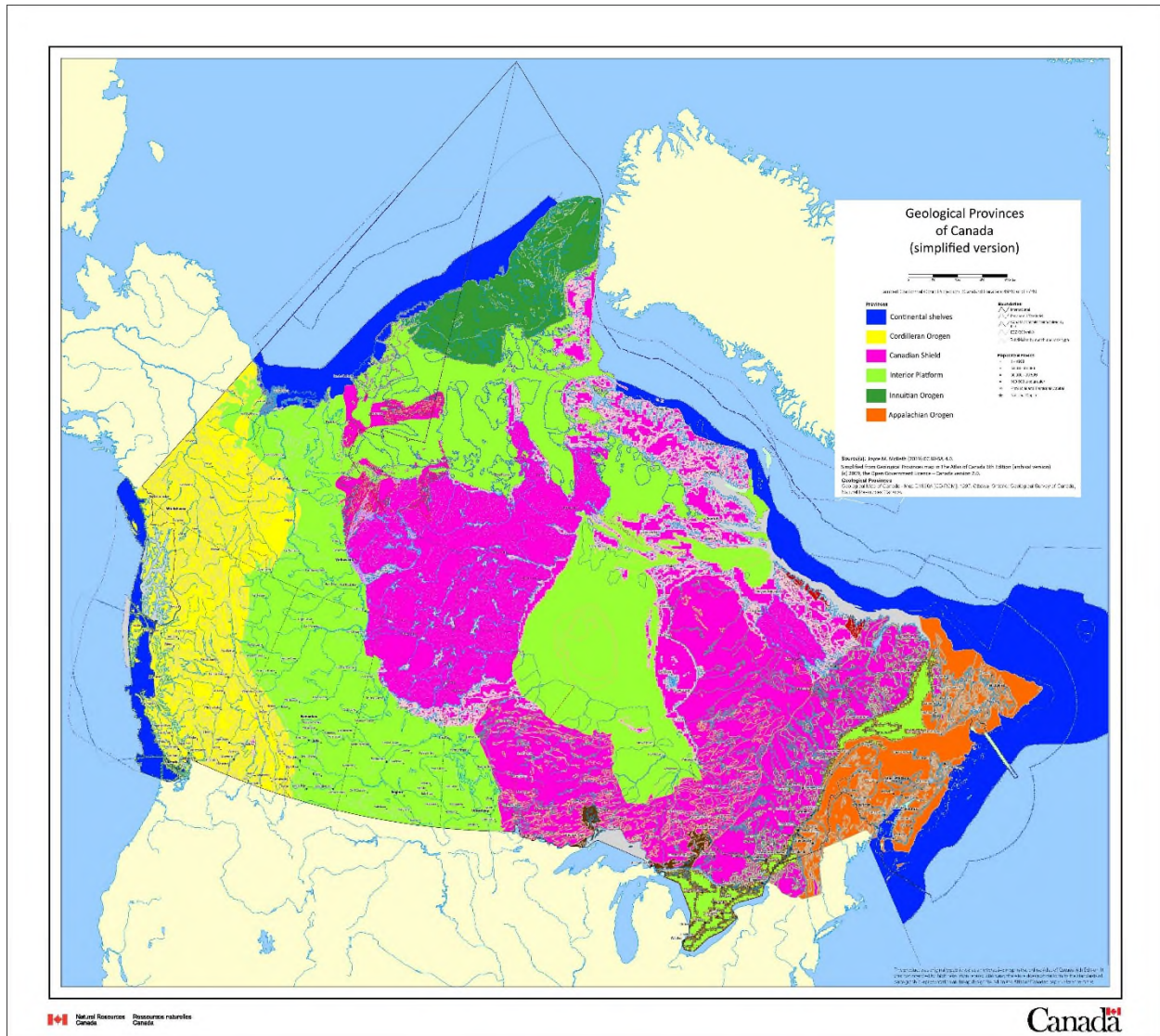
**Figure 1.1** | Geological Map of Canada. Source: National Resources Canada (1996) [Contains information licensed under the Open Government Licence – Canada](#). Geoscan ID 208175. [view source](#)

We encourage you to take some time to explore Canada's Mineral and Energy Resources using the [Interactive Map](#) on the Natural Resources Canada website. As you explore the geological map (Figure 1.1) and interactive mineral resources map of Canada, it is useful to also look at a map of geological provinces in Canada (Figure 1.2) to help understand how Canadian geology broadly varies across the country.

**Geological provinces** are areas where the rocks were formed through similar processes over similar ranges of time. Note that their boundaries are different from the political provinces of Canada. There are 6 geological provinces in Canada: the Canadian

Shield, the Interior Platform, the Innuitian Orogen, the Cordilleran Orogen, the Appalachian Orogen, and the Continental Margins.

The rocks of the **Canadian Shield** (pink regions of the map in Figure 1.2) were formed from 4.6 billion to 541 million years ago, a range of time known as the Precambrian. These rocks formed from melted rock that cooled and solidified, and also rocks that were subjected to high pressure and heat after they formed, creating distinctive banded rocks called gneiss (a type of metamorphic rock). At the time the rocks of the Canadian Shield formed, life on earth looked very different – there were no plants or animals, only single-celled organisms! In contrast, the rocks of the **Interior Platform** (green regions on the map in Figure 1.2) were formed in the Phanerozoic Eon (from 541 million years ago until present). These rocks primarily formed from seawater and from the breakdown of older rocks into tiny particles that were deposited into thick deposits of sediments top of older Precambrian rocks.



**Figure 1.2 | Geological Provinces of Canada (simplified version).** Source: Joyce M. McBeth (2019) CC BY-SA 4.0. Modified from map "Geological Provinces" from the Atlas of Canada 6th Edition © 2009, based on the Geological Map of Canada – Map D1860-A © 1997, Ottawa, ON, Geological Survey of Canada, National Resources Canada. [Contains information licensed under the Open Government Licence – Canada. view source](#)

In the lab, you will use **bedrock geology maps** (maps of the types of rocks in an area) and **mineral resource maps** (maps of where resources are located in an area) to explore the geology and resources across Canada and in your province or territory.

[Map of Canadian Geology](#)

[Map of Canadian Resources](#)

## **1.3 GEOLOGY & RESOURCE MAPS FOR CANADIAN PROVINCES & TERRITORIES**

We have provided links below to bedrock geology and resource maps for each province and territory (if the maps exist).

### **1.3.1 SASKATCHEWAN GEOLOGY & RESOURCES**

[Map of Saskatchewan Geology](#)

[Map of Saskatchewan Resources](#)

Links for other provinces are provided on the [lab manual website](#).

# Exercises on Canadian Geology

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<https://openpress.usask.ca/geolmanual/chapter/canadian-geology-exercises/>

Note: If you are a student, please answer the questions in these exercises based on maps for the province or territory where you are attending university.

Your name: \_\_\_\_\_

NSID and Student number: \_\_\_\_\_

Date and lab section time: \_\_\_\_\_

TAs' names: \_\_\_\_\_

***Please add your name and email address to the sign-in sheet at the beginning of lab this week to ensure your TAs have contact details to email you about important lab news!***

Your TA will check that you have completed the questions at the end of the lab. Please hold on to your lab notes to help you prepare for your lab final exam.

## **1-E1 LAB EXERCISES - CANADIAN GEOLOGY & MINERAL AND ENERGY RESOURCES**

1. Before you go through the maps provided in this lab, we are curious what you already know about energy and mineral resources in Canada. It is ok if you don't know much about it yet - you will probably know more by the end of this lab! List as many Canadian energy and mineral resources as you can think of and try to think of one for each province and territory.

2. Here is a list of some of the mineral and energy resources in Canada. Each of these resources can be found on the [Atlas of Canada Minerals and Mining Interactive Map](#), and by searching the web. List 1 or 2 provinces or territories where each resource is found. Challenge: try to find a resource from each province and territory in Canada.

**Column 1**

*Energy resources:*

oil \_\_\_\_\_  
 gas \_\_\_\_\_  
 oil sands \_\_\_\_\_  
 coal \_\_\_\_\_  
 uranium \_\_\_\_\_

*Base metals:*

nickel \_\_\_\_\_  
 lead \_\_\_\_\_  
 copper \_\_\_\_\_  
 zinc \_\_\_\_\_

**Column 2**

*Precious metals and minerals:*

gold \_\_\_\_\_  
 silver \_\_\_\_\_  
 diamonds \_\_\_\_\_

*Other metal & mineral resources:*

potash \_\_\_\_\_  
 niobium \_\_\_\_\_

*Quarried building materials:*

aggregate (gravel) \_\_\_\_\_  
 limestone \_\_\_\_\_  
 sand \_\_\_\_\_

**Table 1-E1** | Table of Canadian Energy and Mineral Resources. Source: Joyce McBeth (2018) CC BY 3.0 original work.

3. Now refer to the [Geological Map of Canada](#) alongside the map of the [geological provinces of Canada](#) (found in the overview section of this lab). What pattern do you see in the locations of the different resources you identified in question 2 above and the geological provinces of Canada? Give an example of a resource you find in several geological provinces. Give an example of a resource you find mostly in one geological province.



4. What human factors do you think have (or may have) affected energy and mineral resource development patterns across the country?

## **1-E2 LAB EXERCISES - REGIONAL GEOLOGY & MINERAL AND ENERGY RESOURCES**

1. Refer to your provincial or territorial mineral resource map. What kinds of energy resources (if any) are in your province or territory? Where (roughly) are they located (e.g., near which city)? What kinds of metal or resource mining (if any) occur in your province or territory? Where are they located (roughly)?
  
2. Looking across your province or territory's resources map. Do you notice any broad patterns in how the resources are distributed across the map? Are there more of one kind of resource (e.g., metal mines) in one area than another than another?



5. Now refer to the maps of Canadian mineral resources and Canadian geology. What are 2 or 3 differences between your province or territory's energy and mineral resources and the energy and mineral resources in other areas of Canada?

6. How has this lab changed your awareness of your province or territory's energy and mineral resources and/or energy and mineral resources across Canada?