

Geological Provinces

Abstract

The seventeen geological provinces of Canada are characterized by rocks and structures of varying types and ages. They form one shield (consisting of seven geological provinces), four platforms, three orogens, and three continental shelves.

A geological province is an extensive region with distinctive characteristics that differentiate it from surrounding areas. A shield is a large area of very ancient rocks that have been leveled by erosion. A platform is that part of a continent covered by flat-lying or gently tilted rock and underlain by very ancient rocks consolidated during deformations that preceded deposition of the overlying platform layer. The rocks of the platform layer are usually sedimentary in nature. An orogenic belt is a part of the continent where the Earth's crust has been subjected to deformation leading to the creation of a mountain range. Finally, a continental shelf (or continental platform) represents the extension of a continent under an ocean. It is characterized by a very gentle slope and generally reaches depths of less than 200 metres, at which point there is a steep slope down to the ocean floor.

Canadian Shield

The Canadian Shield forms the core of the continent and occupies almost half of Canada's surface. The Canadian Shield is made up of stable Precambrian rocks. The surface of the rocks is undulating and marked by valleys. Over most of the Shield, average elevation is approximately 300 metres above sea level. The Shield is comprised of seven geological provinces: Bear, Churchill, Grenville, Nain, Slave, Southern, and Superior. Each is distinguished by its unique internal structural trends and style of folding.

The Canadian Shield is rich in metals and minerals of all kinds. The Superior Province is one of the most important sources of metals in Canada and is the location of copper, zinc, gold, iron and silver deposits. The Sudbury mining district in the Southern Province, known for its nickel and copper deposits, is one of the most important mining areas in the world. Major gold deposits are mined in the Slave Province, and copper, lead, zinc, uranium, nickel, cobalt and tungsten have been discovered in the northwestern part of the Churchill Province. The rocks of the Bear Province contain deposits of uranium, copper, chalcocite, copper, bornite and chalcopyrite. For its part, the Grenville Province has deposits of magnetite, pegmatites containing mica, feldspar, apatite, uranium, titanium, as well as zinc and lead sulphides. Few mineral discoveries have been made in the Nain Province.

Platforms

The Canadian Shield is surrounded by the Interior, Arctic, Hudson and St-Lawrence platforms. These platforms are comprised of a basement of Precambrian rocks that are identical to those of the Shield, overlain by beds of much younger, flat-lying rocks.

The Interior Platform, also referred to as the Interior Plains, is located between the Shield and the Cordillera. It is in this geological province that the majority of Canada's oil and gas reserves are located. While most of these are found in Alberta, others are located in Manitoba, Saskatchewan and northeastern British Columbia and all three territories. The Interior Platform is also a source of coal, potash, salt, gypsum, limestone and other non-metallic products.

The Arctic Platform extends under the islands of the Arctic archipelago, between the Innuitian Orogen and the Shield. Some of its strata may contain oil and natural gas.

The St. Lawrence Platform consists of two parts. The southwestern part comprises the Great Lakes Lowlands, and the northeastern part the St. Lawrence Lowlands. Oil and natural gas have also been found and developed here, in the southwestern part of the St. Lawrence Platform. The St. Lawrence Platform in general is a major source of salt and building materials, but contains few metal resources. This province is also the location of the Monteregian Hills, which are the remains of small igneous rock intrusions that are more resistant to erosion than the surrounding lithologies.

The fourth platform, the Hudson Platform, lies beneath Hudson Bay and its lowlands. Little drilling has been carried out in this province and rock outcrops are rare. As a result, the resources of the province are less well documented, although important deposits of gypsum and lignite have been found here.

Orogenic Belts

The orogenic belts are areas that have undergone orogenic movement, (mountain-building episodes), accompanied by volcanic eruptions and metamorphism. The rocks in these belts have also undergone folding, faulting and uplift. Canada has three orogenic belts the Appalachian, Innuitian and Cordilleran which formed at different times.

The Appalachian orogenic belt extends south of the St. Lawrence, east of an imaginary line between Quebec City and Lake Champlain. This orogenic belt includes parts of Quebec and most or all of New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland. This geological province is a source of industrial minerals that include asbestos (Estrie region of Quebec), fluorite and iron (Newfoundland), and copper, zinc, lead, gold and silver (Gaspé region of Quebec and Newfoundland).

The Cordilleran orogenic belt (or Cordillera) is a province of high mountains and plateaus extending along the west coast of Canada. This geological province is part of the zone that borders the Americas, extending as far northwest as the Aleutian Islands. In British Columbia, this geologic province is divided into two regions by an extremely long valley known as the Rocky Mountain Trench, which stretches from the U.S. border to the Yukon. The area between the Pacific Ocean and this valley is formed primarily of plutonic, volcanic and metamorphic rocks. Between the valley and the Interior Platform lie the Rocky Mountains and the Foothills, which are comprised of folded and faulted sedimentary rocks. The western part of the Cordillera is the location of numerous metal deposits as well as industrial minerals and coal. The eastern part yields oil, natural gas and industrial minerals.

The Innuitian orogenic belt extends from Ellesmere Island to Melville Island. The basement of this province consists of highly deformed sedimentary, metamorphic and volcanic rocks. Lead and zinc have been found on Little Cornwallis Island, while magnetite has been discovered on Axel Heiberg Island.

Continental Shelves

The continental shelves or platforms are areas that extend beneath the Atlantic, Pacific and Arctic oceans. Because of the difficulty of ocean drilling, relatively little is known about the composition of the rocks that make up these platforms. However, their approximate boundaries have been established, and it is these boundaries, rather than Canada's shorelines, that are considered to represent the country's continental boundaries. The mineral importance of the continental shelves lies in the presence of oil and gas deposits in the underlying rocks.

Map Sources

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This layer was taken from the CD-ROM: Geological Map of Canada - Map D1860A. This edition of the Geological Map of Canada is the latest produced by the Geological Survey of Canada. It shows the 18 different geological provinces in Canada and surrounding oceans, the main types of rocks and the era when they have been formed.

References

Canada. Geological Survey of Canada. 1981. *Geology and Canada*. Adapted from *Prospecting in Canada* 4th edition by A.H. Lang, published in 1970.
Geological Society of America. *The Geology of North America*, 1988-1997. 11 vol.
Wheeler, J.O. 1996. *About the Geology of Canada*. Geological Survey of Canada.

Related Web sites (1999 – 2009)

Federal Government

Natural Resources Canada. Geological Survey of Canada. Canadian Landscapes
http://gsc.nrcan.gc.ca/landscapes/index_e.php

This collection of photos of Canadian landscapes and landforms is presented as a public service to illustrate the great diversity of Canadian scenery.

Natural Resources Canada. Geological Survey of Canada. Geological Map of Canada
http://gsc.nrcan.gc.ca/map/1860a/index_e.php

These pages comprise the documentation set that appears on the Geological Map of Canada, CD-ROM version (D1860A).

Natural Resources Canada. Geological Survey of Canada. Geoscape Vancouver
http://geoscape.nrcan.gc.ca/vancouver/index_e.php

Geoscape Vancouver - Living with our geological landscape

Natural Resources Canada. Minerals and Metals Sector. Canadian Minerals Yearbook
<http://www.nrcan-rncan.gc.ca/mms-smm/busi-indu/cmy-amc-eng.htm>

Each year, the Minerals and Metals Sector (MMS) of Natural Resources Canada undertakes a comprehensive review of developments in the mineral industry and publishes the results as the Canadian Minerals Yearbook.

Natural Resources Canada. Minerals and Metals Sector. Minerals and Metals -A World to Discover

<http://www.nrcan.gc.ca/RedirNotifs-ss/mms-smm.htm>

The following pages have been created as an educational tour of some of Canada's most important natural resources: minerals and metals.

Other

The Royal Tyrrell Museum - Where Palaeontology Comes Alive!

<http://www.tyrrellmuseum.com/home/>

Web site of the Royal Tyrrell Museum. A palaeontology museum and research facility in Alberta.