2 Canada's Physical Base

Learning Objectives

- To outline the physical basis of Canada's regional geography through descriptions of physiographic, climatic, and ecological regions, tying in soils, vegetation, and hydrology
- To facilitate an understanding of the spatial distribution of natural resources in relation to the physical characteristics of Canada's seven physiographic regions
- To illustrate the symbiotic (two-way) relationship between humans and the environment, in which the environment influences human activity and, at the same time, human activity has an impact on the environment
- To outline global pollution and climate change as major environmental challenges for the twenty-first century
- To provide an overview of the distribution of climatic types and zones in Canada, along with drainage basins

Chapter Overview

Chapter 2 describes the physical basis of Canada's geography and lays the foundation for our discussion of the six regional chapters. Three main aspects of this chapter include:

1. Bone's observation that "physical geography provides the raison d'être for the basis of the core/periphery model" and is a logical consequence of the "geography is destiny" statement found in Chapter 1 (p. 4).
2. The fact that the country's human geography unfolds within the setting of its physical characteristics, and a two-way relationship exists between physical and human geography.
3. Impacts of human activities are visible at all scales, from the local to the global. Climate change is an example of relatively rapid change to our environment that is affecting the human landscape.

Physical Variations within Canada

In a country as large as Canada, it is not surprising that physical geography varies considerably. Nor is it surprising that to understand the variations in human activity across such a country, we need to understand the physiographic, climatic, and ecological variations. This section includes discussion of how human activity is changing the natural environment into an urban industrial landscape as well as causing air, soil, and water pollution.

The Nature of Landforms

Landforms results in three principal types (mountains, plateaus, and lowlands) and **denudation** and **deposition** dramatically reshape the earth's surface over time.

Physiographic Regions

Physiographic regions are defined by surface landforms (**topography**) and underlying geologic structures, and have been dramatically shaped by glaciation. Within the broad discussion of the

physical and environmental processes that have created Canada's regions, Bone provides detailed discussion of each physiographic region.

Geographic Location

Latitude and **longitude** are described, with examples of geographic locations of selected centers in Canada from most southern to northern points.

Climate

Climate and weather are defined and the notion of coldness as a pervasive Canadian characteristic is stated, emphasizing that Canada has a cold environment.

Climatic Change and Global Warming

A distinction is made between **climate change** and **global warming**, and a question is posed: "Is a warmer Canada a better Canada?" There is coverage of climate factors, climatic types and zones, extreme weather events, permafrost, and sea and lake ice.

Major Drainage Basins

Canada has four major **drainage basins** and although the geographic extent of these drainage basins is fixed, the volume of water flowing through them varies by basin. This section includes a description of each basin.

Canada and Pollution

This section addresses the relationship between humans and the environment, pointing out that "humans are the most active and dangerous agents of environmental change" (p. 53). Mining and pollution along with air pollution are two major subtopics of this section. The costs of pollution are substantial, for example in relation to mines which have left behind toxic waste. Air pollution as a result of emissions from industry and transportation sources, most particularly the Alberta oil sands development, is Canada's other major environmental problem.

Challenge Questions

1. Is there a link between physical geography and the core/periphery model? Explain your answer.
2. Is there a link between physical geography and any of the social faultlines? Explain your answer.
3. What are the three main characteristics of physiographic regions?
4. Provide examples of how glaciation has shaped physiographic regions.
5. What is the impact of isostatic rebound on Hudson Bay and James Bay?
6. What is the difference between latitude and longitude? What is the significance of Canada's northerly location? From Table 2.2 (p. 38), name Canada's most southerly and northerly centres.
7. How does the global circulation system redistribute solar energy from low to high latitudes?
8. Based on the information in Figures 2.5, 2.6 and Table 2.4, what are the temperature and precipitation characteristics of the climatic zone where you live?

9. Major hydroelectric projects are planned for which drainage basins?

10. What is the difference between global warming and climate change?

11. Why do scientists believe that global warming would have significant impact in the Arctic?

12. In Canada, what are some of the consequences of global warming?

13. Why are some politicians against the exploitation of Albert's oil sands?

Key Terms

Air pollution Any chemical, physical, or biological agent that modifies the natural characteristics of the atmosphere. (p. 55)

Alpine permafrost Permanently frozen ground that is found at high elevations. (p. 49)

Arctic Circle An imaginary line signifying the northward limit of the sun's rays on the winter solstice (21 December). (p. 33)

Arctic ice pack Floating sea ice in the Arctic Ocean that has consolidated into an ice pack, with an extent of over 10 million km^2. New sea ice (less than one year in age) is often about 1 m thick; old sea ice can reach 5 m in thickness. Ice ridges are formed, reaching 20 m in thickness. Scientists have found that higher temperatures are reducing the geographic extent and thickness of the Arctic ice pack. (p. 50)

Arêtes Sharp mountain ridges that are formed between two cirques. (p. 30)

Basins Structural depressions in sedimentary rock that are caused by the bending of sedimentary strata into huge bowl-like shapes. Petroleum may accumulate in sedimentary basins. (p. 31)

Cirques Large, shallow depressions found in mountains caused by the plucking action of alpine glaciers. (p. 30)

Climate An average condition of weather in a particular area over a very long period of time. (p. 38)

Climate change Change in global climate patterns, with most change apparent since the mid-twentieth century; attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels. (p. 22)

Climatic zone A geographic area where similar types of weather occur. (p. 39)

Continental air masses Homogeneous bodies of air that have taken on the moisture and temperature characteristics of the land mass they originated in. Continental air masses are normally dry and cold in the winter and dry and hot in the summer. (p. 43)

Continental effect Land masses heat up and cool more quickly than oceans. (p. 43)

Continuous permafrost Extensive areas of permanently frozen ground in the Arctic, where at least 80 per cent of the ground is permanently frozen. (p. 50)

Convectional precipitation An upward movement of moist air that causes the air to cool, resulting in condensation and then precipitation. (p. 44)

Denudation The process of breaking down and removing loose material found at the surface of the earth. In this way, erosion and weathering lead to a reduction of elevation and relief in landforms. (p. 24)

Deposition The deposit of material on the earth's surface by various processes such as ice, water, and wind. (p. 24)

Discontinuous permafrost Permanently frozen ground mixed with unfrozen ground in the Subarctic. At the northern boundary of the Subarctic about 80 per cent of the ground is permanently frozen, while at its southern boundary about 30 per cent of the ground is permanently frozen. (p. 50)

Drainage basin Land sloping towards the sea; an area drained by rivers and their tributaries. (p. 50)

Drumlins Landforms created by the deposit of glacial till and shaped by the movement of the ice sheet. (p. 28)

Ecumene The portion of the land that is settled. (p. 21)

Erosion The displacement of material by geomorphic processes such as wind, water, and ice. (p. 24)

Eskers Long, sinuous mounds of sand and gravel that were deposited on the bottom of a stream flowing under a glacier. (p. 28)

Fault line A crack or break in the earth's crust. (p. 29)

Faulting The breaking of the earth's crust. (p. 29)

Folding The bending of the earth's crust. (p. 29)

Frontal precipitation When a warm air mass is forced to rise over a colder air mass, condensation, and then precipitation occur. (p. 44)

Glacial erosion The scraping and plucking action of moving ice on the surface of the land. (p. 28)

Glacial spillway Deep and wide valleys formed by the flow of massive amounts of water originating from a melting ice sheet or from water escaping from glacial lakes. (p. 31)

Glacial striations Scratches or grooves in the bedrock caused by rocks embedded in the bottom of a moving ice sheet or glacier. (p. 28)

Glacial troughs U-shaped valleys carved by alpine glaciers. (p. 30)

Global circulation system The movements of ocean currents and wind systems that redistribute energy around the world. (p. 42)

Global warming An increase in global temperature due to the greenhouse effect caused by increased levels of carbon dioxide, chlorofluorocarbons, and other pollutants in the atmosphere; the main contributor is the burning of fossil fuels. (p. 39)

Greenhouse effect The atmospheric absorption of long-wave radiation from the earth's surface. (p. 40)

Greenhouse gases Water vapor, carbon dioxide, and other gases that make up less than 1 per cent of the earth's atmosphere. (p. 40)

Holocene epoch The current geological division of the Geological Time Chart. The Holocene epoch began about 10,000 years ago and is associated with the warm climate following the last ice age. (p. 46)

Ice age A long cold period accompanied by the appearance of continental ice sheets. The most recent ice age is called the Pleistocene ice age, which began some 2 million years ago. (p. 28)

Igneous rocks Rock formed when the earth's surface first cooled or when magma or lava reached the earth's surface. (p. 23)

Isostatic rebound The uplifting process of the earth's crust following the removal of an ice sheet that, because of its weight, depressed the earth's crust. Also known as "postglacial uplift." (p. 32)

Lake Agassiz The largest glacial lake in North America that covered much of Manitoba, northwestern Ontario, and eastern Saskatchewan. (p. 31)

Latitude A measure of distance north or south, in degrees and minutes, along imaginary lines that encircle the globe parallel to the equator. (p. 37)

Longitude The distance east or west from the prime meridian at Greenwich, England, an imaginary line that runs through both the North and South poles, as measured in degrees and minutes. (p. 37)

Marine air masses Large homogeneous bodies of air with moisture and temperature characteristics similar to the ocean where they originated. Marine air masses are normally moist and mild in both winter and summer. (p. 42)

Metamorphic rocks Rocks formed from igneous and sedimentary rocks by means of heat and pressure. (p. 23)

Muskeg A wet, marshy area found in areas with poor drainage, such as the Hudson Bay Lowland. Muskeg contains peat deposits. (p. 32)

Northwest Passage Sea route(s) through the Arctic Ocean, via waterways through the Canadian Arctic Archipelago, connecting the Atlantic and Pacific oceans. (p. 41)

Orographic precipitation Rain or snow created when air is forced up the side of a mountain, thereby cooling the air and causing condensation followed by precipitation. (p. 44)

Patterned ground The arrangement of stones and pebbles in polygonal shapes. Patterned ground occurs in the Arctic where continuous permafrost exists and where frost shattering is the principal erosion process. (p. 33)

Peneplain A more or less level land surface resulting from the erosion of ancient mountains. (p. 35)

Permafrost Permanently frozen ground. (p. 33)

Physiographic region A large geographic area where a single landform, such as the Interior Plains, is found (p. 24)

Physiography The study of landforms, their underlying geology, and the processes that shape these landforms. (p. 22)

Pingos Hills or mounds that have an ice core and that are found in areas of permafrost. (p. 34)

Plate tectonics The study of movement in the seven large pieces or "plates" of the Earth's outermost layer, the lithosphere. These plates are floating on the molten material comprising the rest of the interior of the earth. When the plates collide, earthquakes occur. The seven plates are the African, North American, Eurasian, Australian, Antarctic and Pacific plates. (p. 29)

Pleistocene epoch A minor division of the Geological Time Chart beginning nearly 2 million years ago. It forms part of the Quaternary Period and is associated with some 20 ice ages. (p. 27)

Podzolic A soil order, often grey in colour, identified by poor drainage; associated with the boreal forest and the coastal rain forest and with climates that have large amounts of precipitation, such as the Pacific, Atlantic, and Subarctic climatic zones. (p. 39)

Postglacial uplift The slow rising of the earth's crust following the removal of an ice sheet that, because of its weight, depressed the earth's crust. Also known as "isostatic rebound." (p. 34)

Primary products Goods derived from agriculture, fishing, logging, mining, and trapping; products of nature with no or little processing. (p. 53)

Rain shadow effect Results in dry areas on the lee side of mountains where air masses descend, causing those air masses to become warmer and drier. (p. 44)

Relief A measure of elevation of the land relative to sea level, which is designated as zero. A relief map indicates elevation and/or topographic features, such as a mountain range, by different colours. (p. 24)

Residual uplift The final stages of isostatic rebound. (p. 34)

Restrained rebound The first stage of isostatic rebound. (p. 34)

Sea ice Ice formed from ocean water that freezes. Forms of sea ice include *fast ice*, ice that has frozen along coasts and extends out from land; *pack ice,* floating consolidated sea ice that is detached from land and freely floating, *ice floes*, floating chunks of sea ice that are less than 10 km (less than six miles) in diameter; and *ice fields*, larger chunks of sea ice that are more than 10 km (more than six miles) in diameter. (p. 41)

Sedimentary rocks Rocks formed from the accumulation, in a layered sequence, of sediment deposited in the bottom of an ocean. (p. 23)

Sporadic permafrost Pockets of permanently frozen ground mixed with large areas of unfrozen ground. Sporadic permafrost ranges from a trace of permanently frozen ground to an area having up to 30 per cent of its ground permanently frozen. (p. 50)

Strata Layers of sedimentary rock. (p. 23)

Subsidence A downward movement of the ground. In areas of permafrost, subsidence occurs when large blocks of ice within the ground melt, causing the material above to sink or collapse. (p. 41)

Terraces Old sea beaches left after the sea has receded, old flood plains created when streams or rivers cut downward to form new and lower flood plains. The old flood plain (now a terrace) is found along the sides of the stream or river. (p. 36)

Till Unsorted glacial deposits. (p. 28)

Topography The shape of the surface of the land. Contour maps, using isolines (contour lines) are one representation of topography and/or topographic features, with each line on the map representing the same elevation above sea level. (p. 24)

Tyrrell Sea Prehistoric Hudson Bay as the Laurentide Ice Sheet receded. Its extent was considerably greater than that of present-day Hudson Bay because the land had been depressed by the weight of the ice sheet. (p. 32)

Weathering The breakup and decomposition of rock and particles in situ. (p. 24)