Chapter 3 Landforms

Canada is a country with diverse physical features.

With one of the longest coastlines in the world one can discover a variety of coastal features:

bays, gulf, islands, peninsulas, isthmus's, straits, fiords, sea caves, sea stacks, sea arches and towering cliffs.

Canada has majestic mountains, rounded hills, vast plains and plateaus. As well there are ice fields and glaciers.

All of these physical features are affected by forces of erosion:

- Rain
- Sleet
- Running water
- Ice
- Temperatures
- Vegetation roots
- Wind

Erosion has been affecting our landforms for millions of years and continues to do so even today.

One of the most spectacular forms of erosion was the Ice Age. It began over a million years ago and lasted until 10,000 years ago.

During the Ice Age a massive sheet of ice called a glacier covered Canada and the northern region of the United States. It was approximately 3 km thick.

Rocks are classified according to age. Our geological past goes back as far

as 4800 million years ago. The past is divided into units called eras.

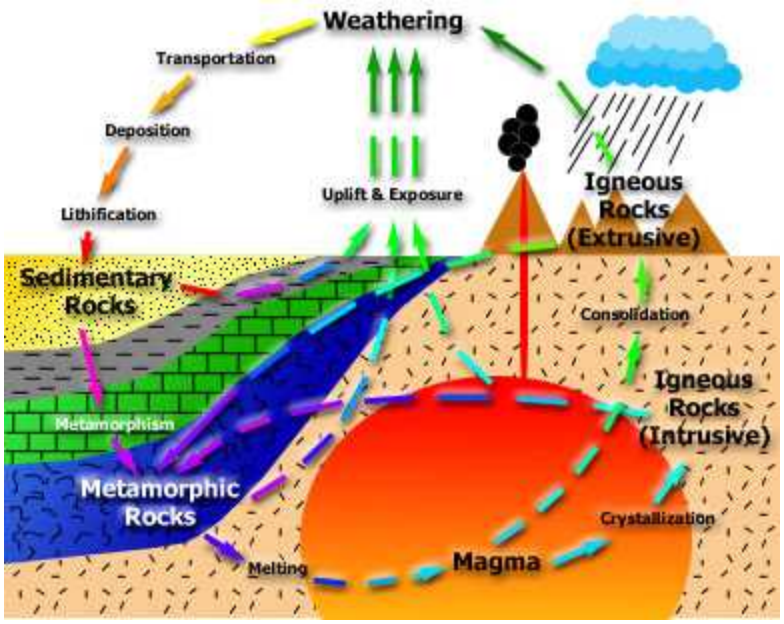
Cenozoic Era: 70 Million Years to Present

Mesozoic Era: 225 Million Years to 70 Million Years

Paleozoic Era: 600 Million Years to 225 Million Years

Precambrian Era: 4800 Million Years to 600 Million Years

Over 4800 Million years rocks on the earth have experienced a change in their composition, texture, and structure. These changes refer to the rock cycle.



Rock Patterns

Igneous Rock

Rock which has solidified from molten magma (liquid rock that rises from the inner core of the earth and cools as it reaches the surface of the earth) and forms one of the three main types of rocks which comprise the earth's surface.

50% of Canada is covered in igneous rock; this area is called the Canadian Shield. The rock is impervious whereby water cannot pass through resulting in many lakes and ponds and rivers.

Metamorphic Rock

Rock that has been transformed by heat and pressure beneath the earth's surface. It contains many valuable minerals.

Sedimentary Rock

Rock that consists of sediment (clay, silt, and pieces of small rock fragments) usually with a layered appearance. The sediments usually come from pre-existing rocks which have been broken up and then transported by water, wind and glacial ice.

Assignment: Igneous, metamorphic and sedimentary rocks are part of a rock cycle. Refer to Figure 3.13 on page 32. Draw and label the diagram in your notebook.

Chapter 3

Formation of Mineral Deposits

Molten magma rises to the earth's surface, cools, and hardens. Minerals in

the molten rock are created by the heating and cooling processes and with pressure settle into the crust of the earth. (Igneous rock)

Minerals are found in lower layers of sedimentary rock (build up of organic and inorganic materials on lake floors compresses sediments together to form solid rock layers).

Four Regions of Canada

1. Canadian Shield

S Land mass of hard granite rock that covers over 50% of Canada.

S Contains some of the oldest rock types in the world.

S Eroded over millions of years. Its elevation (height above sea level) was once over 6000 metres. Today it is between 300 and 600 meters. Jagged ridges now rounded in appearance due to erosion by natural forces dominant the landscape.

S Contains a variety of minerals of tremendous value.

Canadian Shield is composed of igneous rock that is gradually eroded.

1. The eroded particles may be carried by water, wind or ice to other locations like the lowland regions or into the ocean and lakes. The eroded materials build up and under their own pressure gradually become hardened into sedimentary rock.

2. The igneous rock may also be placed under intense heat and pressure and be transformed into metamorphic rock.

3. Through plate movement (the earth's crust is made up of several plates that float atop semi-molten rock) igneous rock could be transported back into the earth's crust and melted by magma (liquid rock).

Typical Landscape of the Canadian Shield

- Rugged (various levels)
- Forests emerge from rocky hills (coniferous - needle-bearing)
- Lakes, ponds, rivers are abundant
- Rich deposit of minerals
- Islands

Minerals found in Canadian Shield

Metallic (containing metal): Iron-ore, copper, nickel, silver, gold, zinc, and magnesium.

Non-metallic: rock salt
Provinces that share the Canadian Shield:

Labrador
Quebec
Ontario
Manitoba
Saskatchewan
Nunavut
NWT

B. Interior Plains

The rocks of the Canadian Shield eroded and were carried by rivers, streams and ice westward. Eventually they were deposited in the area known as Interior Plains (Prairies).

Manitoba, Saskatchewan, Alberta and NWT are represented by the Plains.

As the Canadian Shield continued to erode more sediment was transported - layer on top of layer of rich sediment. Over millions of years the sediment transformed into sedimentary rock. This rock buried evidence of life (plant and animal). Decayed remains of these plants and animals formed rich deposits of oil and gas.

Other minerals include: potash and gypsum.

C. Lowlands

Low-lying land of a region. It is near sea level usually.

Three lowlands in Canada:

Great Lakes-St. Lawrence

- Located in Ontario and lower Quebec alongside the Great Lakes and St. Lawrence River.

- Has some of the most productive farmland in all of Canada because

of the deposition of rich sediment following the Ice Age.

- Has many forms of transportation (river/seaway, railway, roads, canals/locks.
- Contains the bulk of Canada's manufacturing industries and some heavy industries.
- The Great Lake-St. Lawrence Lowlands was formed over a million years ago. The eroded sediments of the Canadian Shield and Appalachian Mountains were either deposited by the glacier of the Ice Age and/or washed down by rivers and streams.
- Many of Canada's large cities are located here.
- Regarded as the heartland of Canada.

Hudson Bay

- The area south of Hudson Bay
- Flat sedimentary rock that is rich in minerals.

Arctic

- Scattered among the islands of the Arctic region.
- Valuable mineral deposits.
- Permafrost (ground frozen below the surface) year round.

D. Mountains

Three systems:

Western Cordillera (Rockies) in the West

Appalachians in the East

Innuitians in the North (Perhaps the less known)

Read page 44 and examine diagram 3.24.

Convection: Process by which heat is transferred from one part of a liquid or gas to another.

Plates: Segments of the earth's crust that move around on liquid. They collide, pull apart and rub each other.

Plate Tectonics: Theory that earth contains 8 large plates and several small ones. (Page 44). The movement of plates causes earthquakes and volcanic activity.

Major Land Forms

Mountains: A mass of land considerably higher than its surroundings. Elevation 300 metres above sea level.

How are mountains formed?

1. Faulting: Fracture of the earth's surface along which movement has taken place. It may occur in any direction: vertical or horizontal. The two plates colliding create a compressional force resulting in one plate being pushed up over the other plate to form a mountain.

2. Folding: The bending, doubling and pushing upwards of rock when

two plates collide.

Western Cordillera Mountain System

- Consists of the Rocky Mountains and Coastal range situated on the Pacific Ocean.
- This chain of mountains were formed when the heavy pacific plate collided with the lighter American plate (page 44) The lighter American plate under Canada was forced up over the heavier one.
- This movement folded and uplifted much of the sedimentary rock on the surface thus creating the folded Western Cordillera.
- It was formed some 65 million years ago.
- The mountain chain appears high, rugged and jagged.

Appalachian Mountain System

- One of the oldest mountain chains in the world.
- Formed when the sediments of the Canadian Shield were deposited in surrounding shallow seas.
- Some 300 million years ago the American plate and the Eurasian plate collided causing sediments to fold (bend and buckle) thus rising up. Volcanoes were also created.
- However, unlike the Western Cordillera Mountains, the Appalachian Mountains are not regarded as high mountains today because erosional forces have made them smooth, rounded and lowered.

Innuitian Mountain

- This mountain system is old and little is known about it.
- The system is low in appearance, snow covered, and located high in the Arctic region of Canada.

Western Cordillera is located in the Yukon, British Columbia and Alberta.

Appalachian Mountains are located in Newfoundland and Labrador, Nova Scotia, and New Brunswick.

Hills: Small portion of land elevated above its surroundings. Elevation of a hill is from sea level up to 300 metres.

Plain: An extensive area of level or gently sloping and rolling land, usually of low elevation. Typically called grassland but also created by sand, silt, soil, and glacial material called till. E.g. Prairies of Western Canada.

Plateau: An extensive level or mainly level area of elevated land. It is usually higher than the surrounding land.

Page 34: Profile along a straight line.
Page 27: Complete Figure 3.1

Mountains are young (million years old) or old (hundreds of millions of years old).

Old mountains are distinguished from young mountains by their appearance - features. Old mountains are typically worn down, eroded with smooth surfaces.

Young mountains have sharp, jagged ridges with peaks.

Page 46 Figure 3.25

Water Forms

Bay: A wide indentation into the land formed by ocean waves and currents. Examples.

Gulf: A large, deep bay; an extensive inlet penetrating into the land. It may have been formed either by a fracture of part of the earth's crust or by the sea/ocean overflowing depressed land.

Strait: A narrow stretch of sea connecting two extensive areas of sea. It may have been formed by fractures across an isthmus (narrow strip of land connecting two larger pieces of land) or by the sea overflowing land, which had subsided, or by erosion.

Tributary: A river or stream which contributes its water to a main river by discharging it into the river from either side or point along its course.

Delta: A fan-shaped deposit of sediment (soil) formed at the mouth of a river. The deposit of sediment material is greater than the removal rate by the running water.

Drainage Basin: A region, which drains all the river water that falls on it into a river or stream, which then carries the water to the sea or a lake. The ridge beyond which water flows in the opposite direction away from the basin defines its boundary. It is an area drained by its river and tributaries.

Four major Drainage Basins in Canada with Major Rivers and Streams

Arctic: NWT, Northern British Columbia, Northern Alberta, and Northern Saskatchewan

Pacific: Yukon, Western British Columbia, Southern Alberta

Atlantic: Newfoundland and Labrador, Prince Edward Island, Nova

Scotia, New Brunswick, Eastern Quebec, Southern Ontario

Hudson Bay: Ontario, Quebec, Manitoba, Saskatchewan, Southern Alberta

Numerous rivers and streams flow into these basins - name a few.

Factors that determine the value of a drainage basin.

Evaporation Rate: amount of water that is changed from a liquid to a vapour.

Run-off Rate: affected by the slope of the land, temperatures, vegetation cover, soil and rock types, and intensity of precipitation.
Water that runs off the land.

Water Wealth: # of people that depend on a river flow (water). This determines the value of a river,

Three Stages of a River:

Youthful
Maturity
Old Age

Page 110 Figure 7.8

Draw, label, and briefly explain each stage.

Stages of a River
Youthful:

- Found usually in highland or mountainous regions.
- Steep slopes.
- Relatively small volumes of water and rapid flow.
- Soil/rocks roll along the stream bed wearing down hill slopes as water flows down.
- Narrow v-shaped valleys that are fairly straight.
- Rapids and waterfalls are common.

As a river's cycle progresses most of the high relief around the river's banks will have eroded away resulting in stage 2.

Maturity:

- Many well-developed branches or tributaries because the drainage pattern has had sufficient time to develop.
- Broad, flat river valley with a well-developed flood plain (flat piece of land, bordering a river, which has been formed from deposits of sediments carried down by the river).
- River channel is broad because the flow of water erodes the sides of the river.

- River begins to meander (turns).
- Water flow slows down.

Old Age:

- Almost no slope.
- Very little water speed.
- Many meandering courses.
- Oxbow lakes: lakes formed when meandering becomes curved and are cut off when water recedes.
- Water very muddy.
- A lot of debris (soil, stones, and silt carried down).

Human Responses to Land and Water Forms

Canadian Shield contains valuable minerals and timber resources (Boreal Forest). Because of these resources mining activity and forestry activity are carried out.

Most of the mining centres are situated around the outside edge of the Shield. These centres would be exploited first because they are closer to established transportation networks, allowing the minerals to be transported with less difficulty and expense to markets in Southern Canada and the USA.

Minerals - mining extraction and smeltering is carried out in the Shield region.

Forest - Sawmills, Pulp and Paper Mills, Lumber Yards are also common in this region.

Absence of Oil and Gas Activity in The Canadian Shield

The Canadian Shield is in an area of ancient igneous and metamorphic rock strata (layers). Oil and natural gas are found in the Interior Plain because the main sedimentary rock layers found there were formed by the compression of sediments deposited in warm shallow seas. The rock layers are several thousand metres thick and took million of years to form. Part of this sedimentary rock consists of coral reefs that once formed close to the surface of the land. Much of the oil and gas is found in these ancient coral reefs.

Oil and natural gas development, agricultural activities, and mining especially potash: mineral crushed into fine material and use as a fertilizer.

Potash in the Interior Plains

When some of the shallow seas covering the Interior Plains (the area that is now Saskatchewan) evaporated, thick layers of mineral deposits were left in the dried out sea bed. These layers are not deep in the earth. Newer rocks and glacial deposits cover them. Today, potash is mined from these layers and used as a fertilizer in Canada and overseas.

Page 27. Complete Question #1