Geoscape Ottawa-Gatineau

Grade 7 Lesson Plans to accompany the Geoscape Ottawa-Gatineau poster and website
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Theme Three: Changing Landscape

List of Expectations		
Grade	Strand and Topic	Expectations
7	Science: Earth and Space Systems The Earth's Crust	• investigate the formation of the physical features of the earth's crust • describe, using simulations or models, the origin and history of natural features of the local landscape • compile qualitative and quantitative data gathered through investigation in order to record results using charts produced by hand
7	Geography: Patterns in Physical Geography	• identify and explain how land-forms are used to delineate regions

Overview

The Geoscape "Changing Landscape" theme involves lessons dealing with geological processes such as erosion and deposition by glaciers and rivers, which have been responsible for the geoscape of today.

At the end of these lessons, students will be able to:
- explain the evolution of the present landscape in the Ottawa-Gatineau area
- explain how the glaciers contributed to the formation and retreat of the Champlain Sea
- determine the flow patterns of major river systems in Ottawa-Gatineau area and how they have evolved

Suggested Lessons	Brief Description
Students Take Notes	Changing landscape: The recent past
Key Word Game	Word Search Game
Lesson 1	
Lesson 2	Label the Champlain Sea diagram Using a reproducible diagram of the retreating glacier and the Champlain Sea, glacial erosion and deposition into the Sea can be discussed as a group. Students can label the diagram.
Lesson 3	As the River Evolves A lesson that involves an explanation of the change in the flow patterns of the Ottawa River using an overhead.
List of related web sites and resources	Urban Geology of the National Capital Area: Glacial history and an interactive map of surficial deposits of the area. http://gsc.nrcan.gc.ca/urbgeo/natcap/surf_introduction_e.php . Champlain Sea fossils are described. Champlain Sea Map. http://www.geo.ucalgary.ca/~macrae/t_origins/champlain/champlain.html

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Students take notes

Changing Landscape: The Recent Past

Ice Sculpts the Land

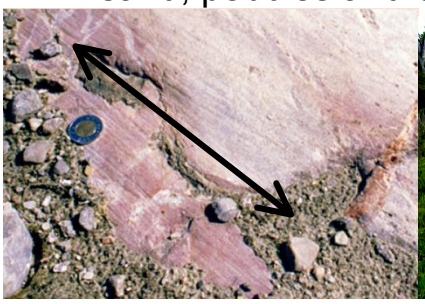
Glaciers are large masses of moving ice on land.

How do glaciers form?

- As layers of snow accumulate over many years, the underlying layers are compacted and the snow recrystallizes to form ice.
- As ice builds up, the pressure of its own weight causes the glacier to flow
- The ice mass spreads out from the snow accumulation area, slowly covering more and more land.
- When they are very large, we call it an ice sheet.

Ice sheets flowed over the Ottawa-Gatineau area many times.
When did they start? 1.6 million years ago
When did they end? 11 000 years ago
How do we know? The shape of our landscape:

- hills have been rounded by erosion (Gatineau Hills and Kanata outcrops)
- bedrock surfaces have been scratched (striae) by stones held in the moving ice
- isolated boulders (erratics) that have been transported from other areas by glaciers
- much of the bedrock is covered by till which is a loose mixture of clay, sand, pebbles and boulders eroded, carried, then deposited by glaciers



striae

quartzite erratic

glacial till

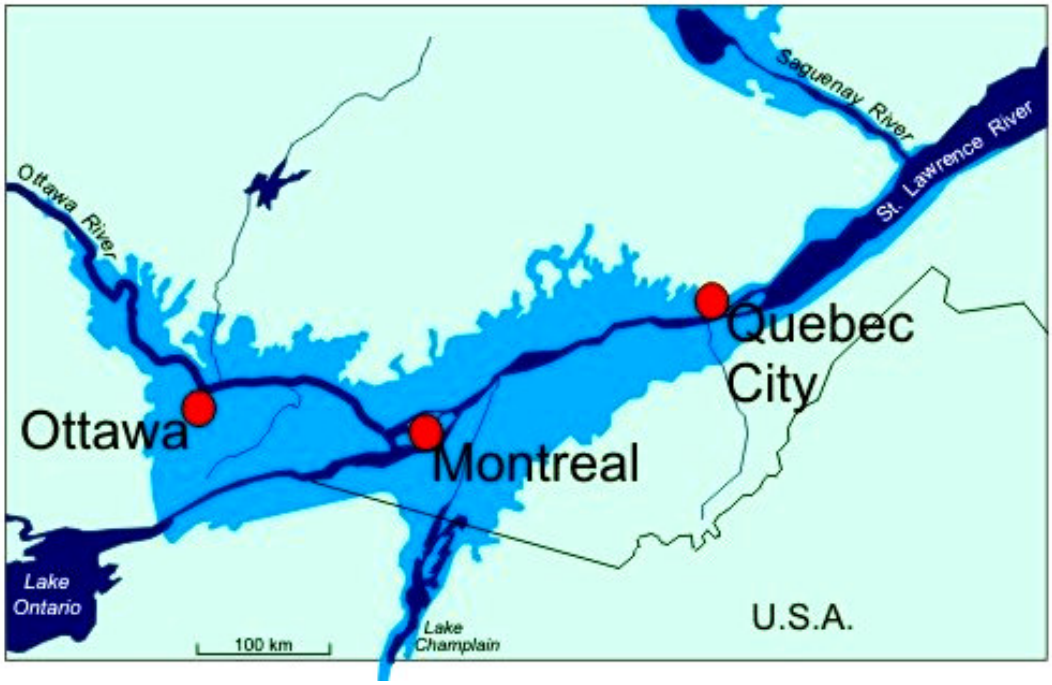
Students take notes

Changing Landscape: The Recent Past

Seaside Ottawa

Glaciers covered the Ottawa-Gatineau area for many years

- the weight of the glaciers was very heavy
- the ground beneath the ice was temporarily depressed (pushed down)
- 12,000 years ago, the last ice started melting away from this area
- water from the Atlantic Ocean flooded the region while the ground was still depressed. This was called the Champlain Sea



- marine life including whales existed in the Champlain Sea
- over the next 2000 years the land slowly rose and, 10,000 years ago, the sea left the area

Today we have evidence of this sea:

- beaches and deltas now lying 220 m above present sea level
- "Leda clay", mud containing marine fossils, covers much of the area
- marine fish were trapped in isolated basins and some still survive e.g. Stickleback fish in Pink Lake
- the "Red" trout is a form of salmon that has learned to live in fresh-water

Students take notes

Changing Landscape: The Recent Past

The River Evolves

The amount of water that flowed in the Ottawa River was much greater between 10,000 and 8,000 years ago than it is today.

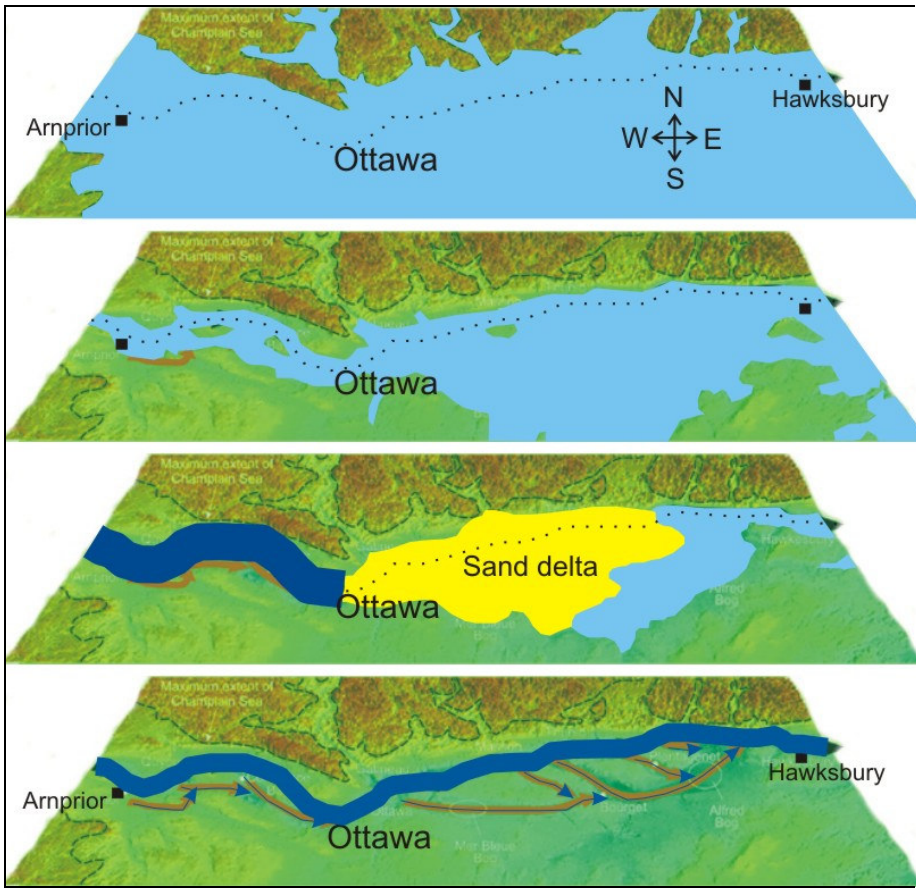
Why? The water from melting glaciers formed huge lakes which were drained by the Ottawa River.

A.) 12 000 years ago
The Champlain Sea covers the Ottawa area

B.) Land rises
The sea retreats

C.) 10 000 years ago
A mighty river builds a sand delta

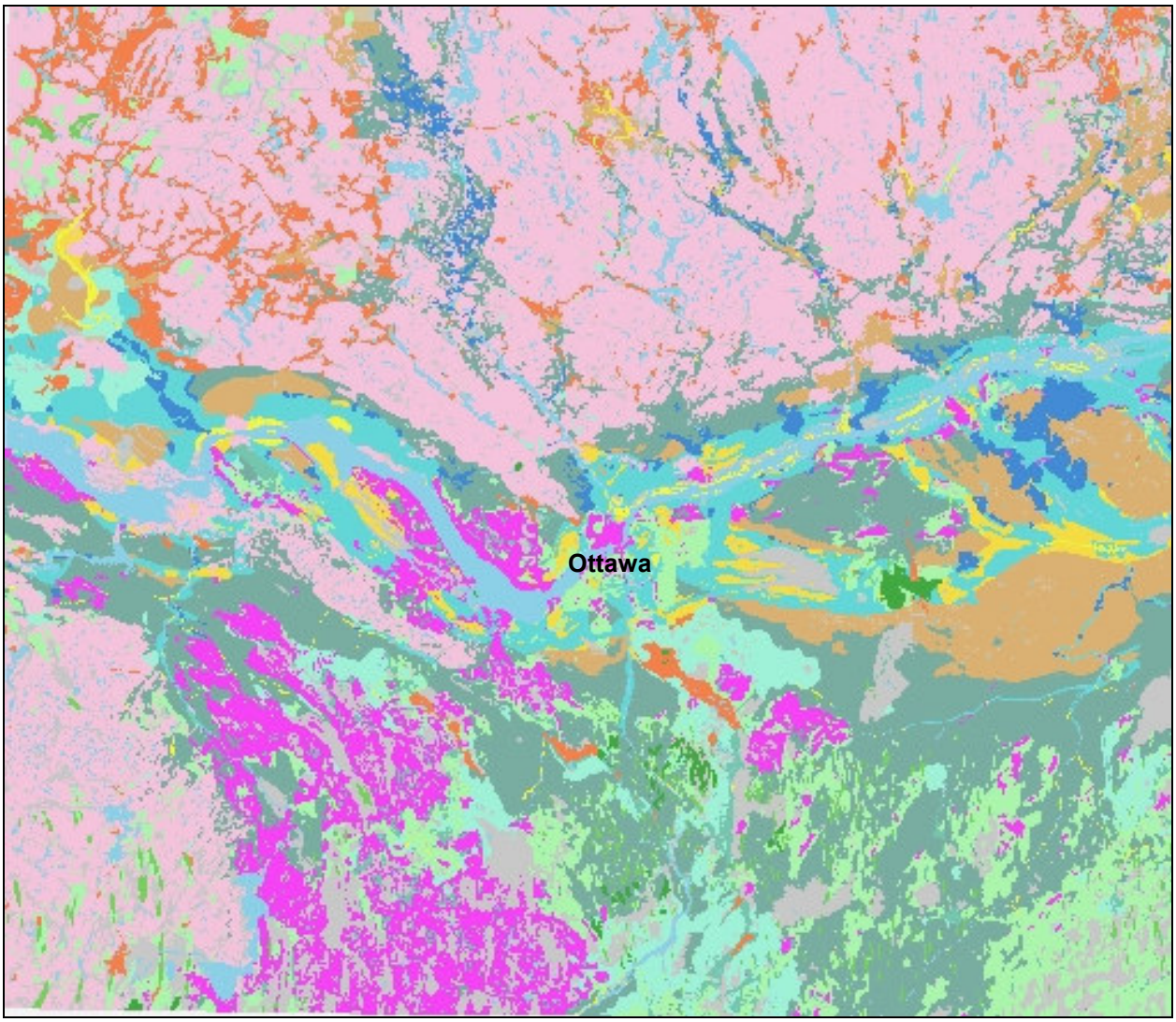
D.) The Ottawa River erodes channels into the deposits of the Champlain Sea



When the glacial lakes were gone and the amount of water flowing down the Ottawa was reduced, some channels stopped flowing.

Peatlands such as Mer Bleue and Alfred Bogs formed on the clay bottom of some abandoned channels.

Surficial Geology / Géologie de surface



Géologie de surface	Surficial Geology
Dépôts organiques	Organic deposits
Dune, dépôts sableux remanies	Sand dunes
Plaines d'inondation, sable, silt et argile	Floodplains, sand, silt, clay
Terrasses fluviales, sable et silt	Fluvial terraces, sand, silt
De pots fluvioglaciaires remanies	Reworked marine sediments
Plages, blocs, gravier et sable	Beach formations
Sable dépôts fluvioglaciaires remanies	Sand, reworked glaciofluvial
Dépôts deltaïques et estuariens	Deltaic and estuarine deposits
Dépôts marines, argile et silt	Marine deposits, clay, silt
Terrasses d'érosion	Erosional Terraces
Dépôts fluvioglaciaires	Glaciofluvial deposits
Till, plaine	Till, plain
Till, a drumlins	Till, drumlinized
Till, bosselé a fortement ondule	Till, hummocky to rolling
Roche en place paléozoïque	Paleozoic bedrock
Roche en place précambrien	Precambrian bedrock
Eau	Water

Urban Geology of the National Capital Area : Online data http://gsc.nrcan.gc.ca/urbgeo/natcap/index_e.php
Géologie urbaine de la région de la capitale nationale : Données en ligne http://gsc.nrcan.gc.ca/urbgeo/natcap/index_f.php

Word Search Game **Changing Landscape** ***name:***

J	Y	M	Q	Y	N	W	Y	F	Z	H	Q	G	K	S
R	G	L	A	C	I	A	L	O	U	T	C	R	O	P
N	E	U	D	N	L	T	J	S	W	Q	T	A	E	Y
R	O	T	U	C	O	E	Q	S	G	I	G	V	E	A
M	E	I	A	D	E	B	R	I	S	T	A	E	T	B
F	R	D	S	W	Y	K	B	L	L	E	P	L	G	Y
B	E	R	R	A	T	I	C	S	A	S	E	N	N	C
L	T	K	P	S	R	L	P	O	T	D	I	H	Y	I
E	R	O	D	E	I	B	E	C	R	K	T	F	W	Z
R	E	N	T	K	B	L	A	M	C	D	S	C	K	I
J	A	A	H	B	U	B	T	U	J	V	E	X	F	D
S	T	E	I	L	T	I	L	L	H	R	J	B	U	H
D	K	R	R	O	A	P	A	E	I	A	Q	G	M	R
R	P	G	V	S	R	A	N	K	S	L	Y	F	F	E
N	P	Z	M	O	Y	K	D	K	M	P	K	R	I	P

1. _____: process of wearing away or scraping
2. _____: solid rock underneath soil and loose sediments
3. _____: a strip of sediment, usually sand but sometimes pebbles, that extends from the water line to a zone of permanent vegetation.
4. _____: very fine grained sediment that can be soft when moist but hard when fired.
5. _____: fragmented material resulting from disintegration of solid sediment or rock
6. _____: a (triangular shaped) deposit of alluvial sediment formed at the mouth of a river where it enters a larger body of water
7. _____: the action of placing something firmly in a surrounding mass
8. _____: to slowly wear away
9. _____: isolated boulders deposited from glaciers
10. _____: the remains or traces of a plant or animal that have been preserved by natural causes and hardened into rock
11. _____: relating to the glaciers
12. _____: sediments composed of small, loose, rounded fragments of rock that have a size that is greater than 2 millimetres (larger than sand)
13. _____: When disturbed, this clay commonly found in the St. Lawrence Lowlands may loose its strength, turn into a liquid mud, and flow as a landslide
14. _____: water that results from melted snow or glaciers
15. _____: part of a rock formation that can be seen on the surface
16. _____: partially decomposed vegetation that, when dried, is used in gardening or as fuel
17. _____: an area of land rich in peat
18. _____: small stones that have been rounded by water or glaciers
19. _____: the process of glacial erosion in which frozen particles are pulled off the rock by the ice
20. _____: the gradual (year after year) melting of a glacier which causes it to reduce in size and the ice front recede
21. _____: a sediment formed of small particles. Can be found in beaches and deserts
22. _____: very fine sediment (grain size 1/256 – 1/16 mm)
23. _____: sediment, of mixed grain size, deposited by a glacier
24. _____: a river or stream that flows into a larger body of water

Changing Landscape

1. Abrasion
2. Bedrock
3. Beach.
4. Clay
5. Debris
6. Delta
7. Embed
8. Erode
9. Erratics
10. Fossils
11. Glacial
12. Gravel
13. Leda Clay
14. Meltwater
15. Outcrop
16. Peat
17. Peatland
18. Pebbles
19. Plucking
20. Retreat
21. Sand
22. Silt
23. Till
24. Tributary

3.1 Lesson 1:

Student worksheet

3.2 Lesson 2: Label the Champlain Sea diagram

Brief Description
Using a overhead diagram of the retreating glacier and the Champlain Sea, glacial erosion and deposition into the sea can be discussed as a group. Students can label a reproducible diagram.

Suggested Materials
Overhead Projector or LCD Projector
Overhead of Champlain Sea diagram or Geoscape website:
http://geoscape.nrcan.gc.ca/ottawa/landscape_e.php
Photocopies of Student worksheet

Duration 20 minutes

Instructions

1. On overhead, teacher explains that during glacial retreat, the ice flows forward but the ice front is melting back faster than the ice can move forward.

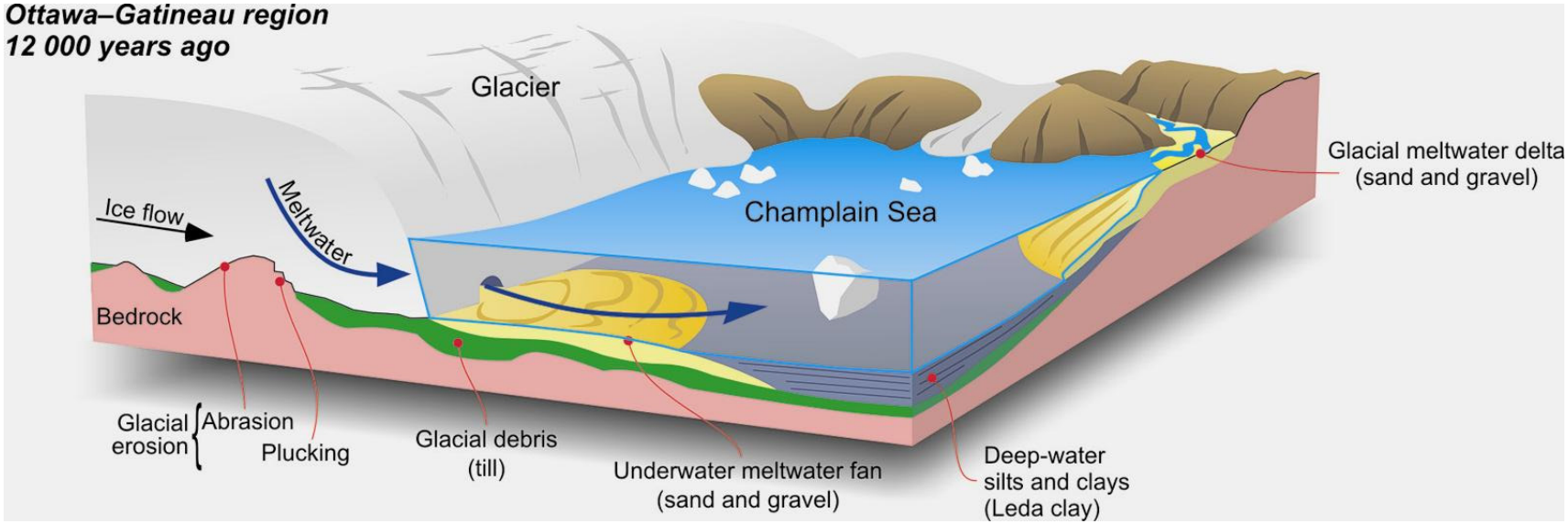
2. Teacher shows that abrasion occurs on the up-ice side of the bedrock hill and plucking occurs on the down-ice side. The eroded material is later deposited beneath the ice as till.

3. Teacher reminds students that the Champlain Sea followed the retreating ice front into the Ottawa valley.

4. Teacher shows that meltwater flowing in tunnels in the ice can enter the sea and deposit its sediment load. Coarse grained sediments are heavier and are deposited close to the ice in a sand and gravel fan, whereas finer sediments (clay) is carried further away into the deeper sea before it settles on the bottom. (This could be demonstrated by observing how a mix of very fine and coarse sediment settles through the water in a beaker.) Meltwater may also flow as rivers across land to the sea, depositing a delta as it enters the sea.

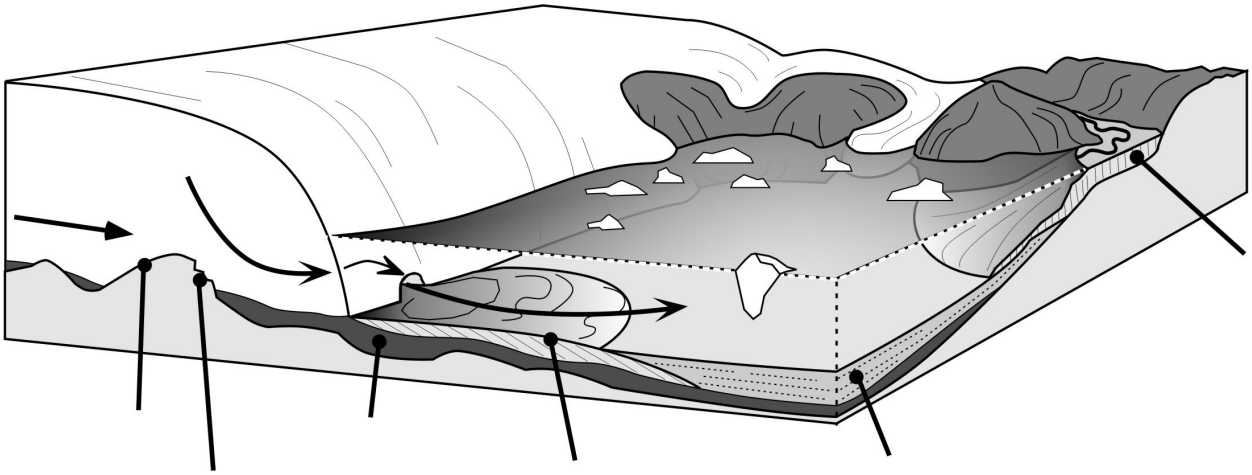
5. Students label their Champlain Sea diagram.

Overhead **The Champlain Sea**



Label the Champlain Sea diagram

1. deep-water silts and clay (Leda clay)
2. meltwater
3. Champlain Sea
4. glacial meltwater delta (sand and gravel)
5. glacial debris (till)
6. abrasion
7. glacial erosion
8. glacier
9. ice flow
10. plucking
11. underwater meltwater fan (sand and gravel)
12. bedrock



3.3 Lesson 3: As the River Flows

Brief Description
A lesson that involves an explanation of the change in the flow patterns of the Ottawa River using an overhead.

Suggested Materials
Geoscape Poster
Pointer
Overheads: “Geoscape satellite image” and “Shifting River Channels”

Duration 20 minutes

Lesson Instructions

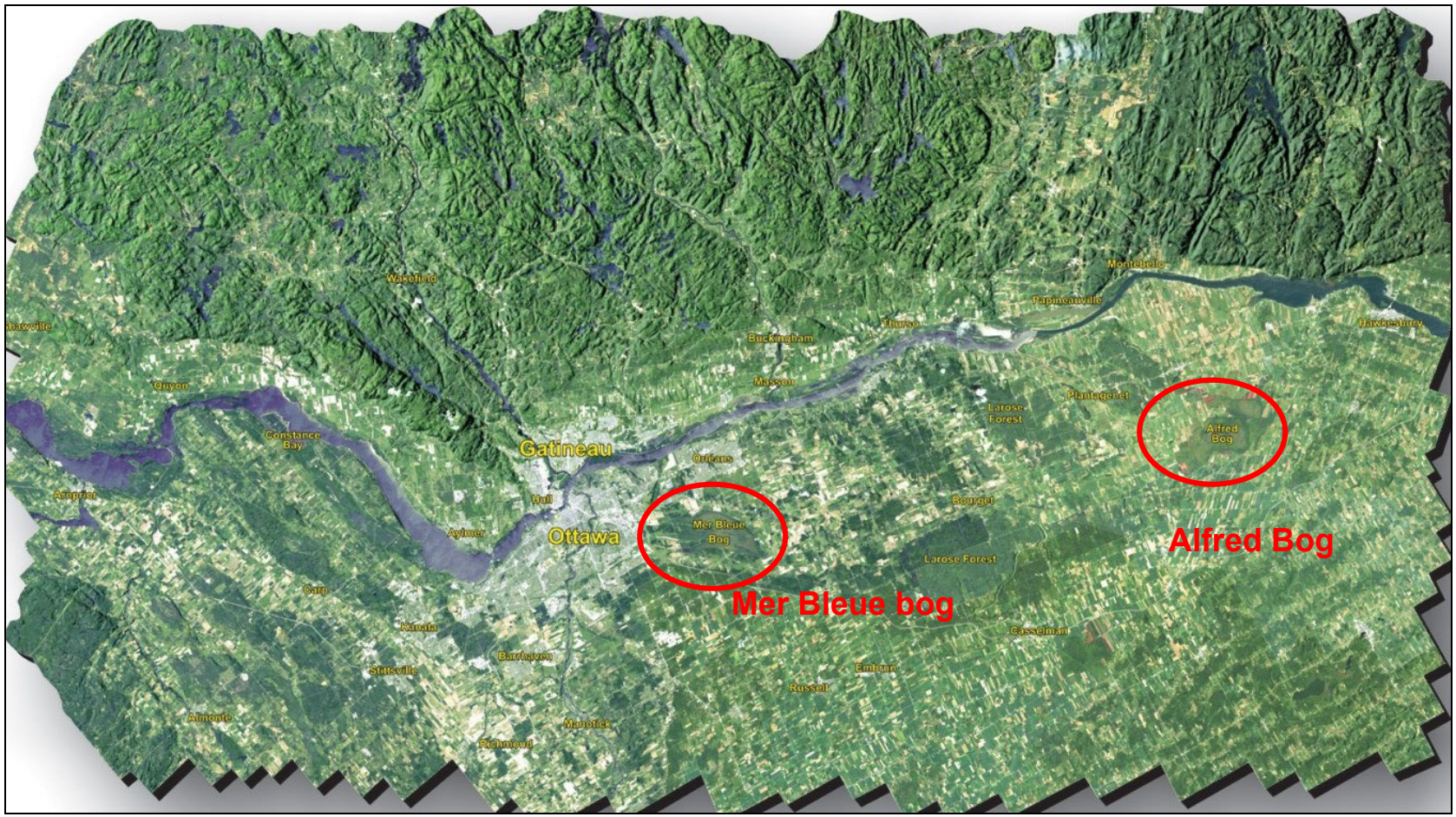
1. Start by quizzing the students about the major rivers in the Ottawa-Gatineau area (Ottawa, Gatineau and Rideau).

2. Ask students to explain the direction of the flow of the rivers with respect to the actual North, South, East, West directions in the classroom (Ottawa river flows West to East, Gatineau River flows south into the Ottawa River and Rideau river flows North into the Ottawa River)

3. Point out the rivers on the main satellite image.

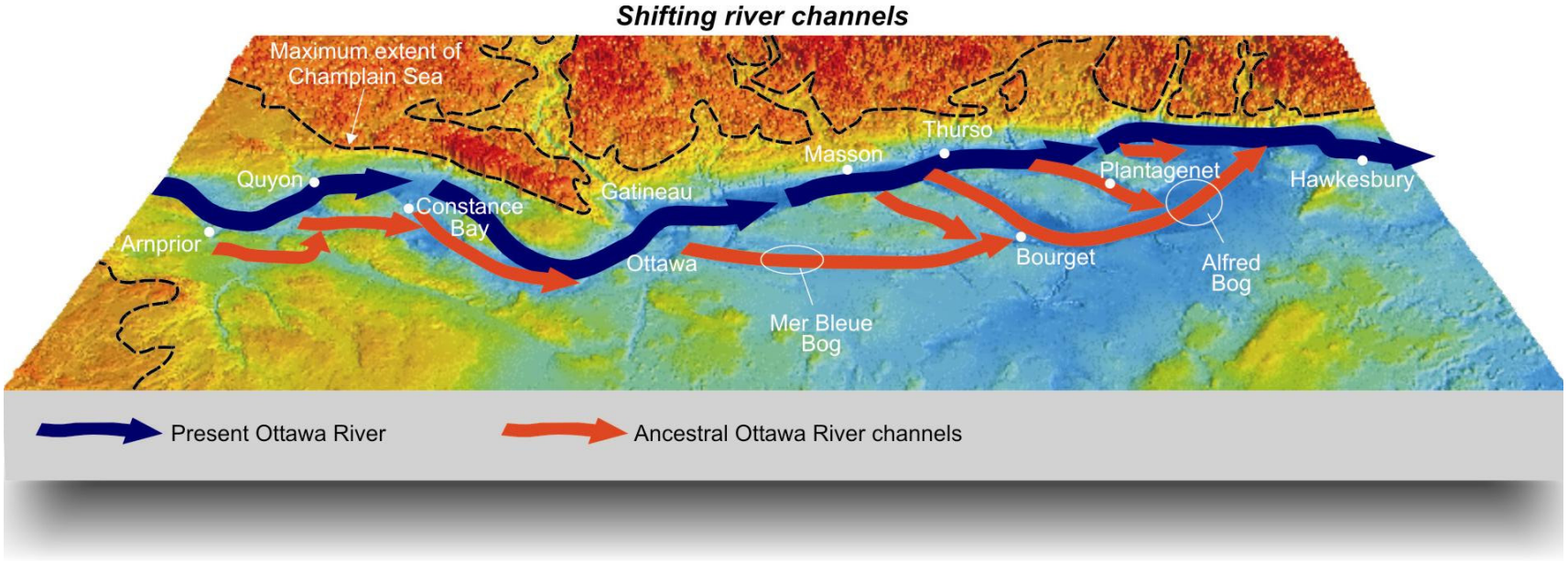
4. Mer Bleue and Alfred bogs are shown. Discuss the difference between lakes, ponds, bogs, marshes and swamps. (Note: close-up air photos of Mer Bleue Bog may be viewed on the City of Ottawa website http://www.ottawa.ca/city_services/maps/atlas/aerial_photos_en.html)
    - Lake: body of water, surrounded by land. Usually larger than a pool or pond.
    - Bog: wet spongy ground of decomposing organic matter (peat) and has poorer drainage than a swamp. May be tree covered.
    - Marsh: a wetland with grassy vegetation that can be the transition between a body of water and land.
    - Swamp: lowland that is seasonally flooded and has more small trees than a marsh and better drainage than a bog.

5. Switch to the “Shifting River Channels” diagram and explain the difference between the blue arrows and the red arrows. Point out the difference in topography from the North to the South of the region.



Overhead: **Geoscape Ottawa-Gatineau satellite image** http://geoscape.nrcan.gc.ca/ottawa/index_e.php

Landsat TM (5/7) Shaded Relief Fusion (Landsat TM 7.)
Data collected by USGS/EROS Data Center and provided courtesy of Canada Centre for Remote Sensing.



Overhead : **Shifting River Channels**