Prehistoric spring in the Ottawa Valley

by Ole Hendrickson

We're having an old-fashioned Ottawa Valley spring. Ice still covers the lakes, even though the fishing huts are long gone. Snow in the highlands, especially on north-facing slopes, is feeding the creeks and rivers and keeping them flowing strong.

That being said, spring isn't what it used to be. Imagine the Ottawa Valley eleven thousand years ago.

Waves lap against towering walls of glacial ice along the Champlain Sea. Melting ice forms rivers that carve the ice and discharge water and sediments. The booming sound of a huge chunk of glacier falling in the water punctuates the silence. This part of the Atlantic is narrow and shallow, generally a tranquil place, protected from wind and wave action. Curious whales venture in, dodging the drifting icebergs.

Thousands of years under the massive Laurentide ice sheet have compressed the land surface 150 meters downward, leaving extensive areas below sea level. As the ice retreats, the ocean flows in.

The oldest fossil seashells from the Champlain Sea era found near Ottawa and Pembroke have been dated at 12,000 and 11,000 years before present (BP), respectively, indicating when these parts of the Valley became covered by the sea. Fossils older than 10,800 BP are true marine species: until then, the western Champlain Sea was nearly as salty as the open Atlantic. Partial skeletons of five whale species – beluga, humpback, finback, harbour porpoise, and bowhead – have been found. A November 30, 1977 Renfrew Mercury article describes the discovery of bowhead whale bones in a gravel pit about 2 km west of White Lake. These were radiocarbon dated at 11,500 BP.

Before the complete disappearance of the glaciers, beyond the seashore freshwater lakes formed in the basins of Golden, Silver, Mink, and Calabogie Lakes; and in Lakes Dore and Clear. These early lakes were far larger than those we see today.

Glacial retreat in the Ottawa Valley was part of a global process. In North America and Eurasia, giant lakes formed along the edges of the retreating ice sheets. Some of these were dammed by the ice, and when the dams failed, gigantic floods carried immense amounts of water to the oceans. Glacial Lake Agassiz was

North America's largest glacial lake, at times extending from Saskatchewan to in the west to Quebec in the east. It formed originally in western Canada where glacial retreat began earliest, and then followed the northeast retreat of the Laurentide ice sheet for at least 5000 years. For a time, a separate large glacial lake, Lake Ojibway, spread along the ice margin in northern Ontario and Quebec.

James Teller of the University of Manitoba, the world's foremost expert on Lake Agassiz, created a major stir in international scientific circles with his 2010 paper showing that around 13,000 BP, Lake Agassiz drained northward through the Mackenzie Valley in a massive flood, adding so much cold fresh water to the oceans that their circulation shut down and Earth went into a little ice age (known as the "Younger Dryas") lasting about 1500 years.

Teller follows the subsequent history of Lake Agassiz in a paper presented at the 1986 Geological Association of Canada symposium in Ottawa. By 11,700 BP it had moved eastward, covering parts of Saskatchewan, Manitoba, northwestern Ontario, North Dakota, and northwestern Minnesota. At this time it discharged southward into the Mississippi River basin.

Around 10,800 BP, ice retreat in the North Bay area allowed a new eastward drainage channel to form. For the next 800 years glacial meltwater from Lake Agassiz flowed via the upper Great Lakes and the Petawawa and Ottawa Rivers into the Atlantic. Flow switched back south for 500 years, and then returned to the Ottawa (via the Mattawa River) between 9500 and 8500 BP. During its final 300 years, Lake Agassiz flowed into northern Ontario, joined glacial Lake Ojibway, and drained into the Ottawa from the north.

The retreating ice sheet had acted as a dam, preventing drainage of Lake Agassiz into Hudson Bay (which was well below the lake level). When this barrier was finally breached around 8200 BP a massive flood triggered another global cooling period of about 300 years.

Throughout its long history, irregular large floods from Lake Agassiz had transported sediment from western Canada into the Ottawa and St. Lawrence valleys. Teller suggested that this contributed significantly to formation of Leda clays deposited in the Champlain Sea basin from Renfrew eastward. He observed that marine fossils disappeared around 10,800 BP when the North Bay outlet opened, freshwater flooded into the Champlain Sea, and its salinity declined precipitously.

How big was the early Ottawa River? In 1983 Teller estimated its maximum flow volume at 200,000 m3/s (compared to 8,000 m3/s today) with an annual average of 50,000 m3/s. In today's terms, the early Ottawa River would be the second largest river in the world. At maximum flow it would rival the Amazon, with its annual average flow around 200,000m3/s.

By 9500 BP the retreat of the Champlain Sea was in full force. Former shoreline areas such as the Petawawa sands were exposed to erosional forces of floods, winds and rain. Terrestrial life appeared. Analyses of plant pollen preserved in bogs indicate that herbs and shrubs first occupied the newly exposed land. Pioneer trees were poplars, with their light, wind-blown seeds; followed by spruces, birch, and eventually pines.

The upper Great Lakes continued to discharge via the Ottawa River for thousands of years after the draining of Lake Agassiz. A 1987 USGS Bulletin, "Geological History of Glacial Lake Algonquin and the Upper Great Lakes", explains that the land surface at the North Bay-Mattawa River outlet gradually rose ("isostatic rebound") after removal of the weight of the ice sheet. This raised the level of the Lake Michigan, Lake Superior, and Lake Huron basins until they overflowed and carved a new outlet into Lake Erie through the St. Clair River. The North Bay outlet was abandoned between 4000 and 4500 BP.

Flow volumes in the Ottawa River declined irregularly, in stages, throughout this period. Terraces along the river's edge (as at Petawawa Terraces Provincial Park) represent distinct periods of relatively steady flow in which the river eroded the glacial deposits along its banks. The highest terraces are the oldest.

Each spring when the snow melts and rivers run full, we can recall the great retreat of the glaciers from the Ottawa Valley, many thousands of years ago.

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