The Ice Push Ramparts at Cherry Pond in Jefferson, New Hampshire

Visitors have often wondered about the origin of the unusual rocky berm or ridge at the edge of Cherry Pond along the Shore and Rampart Paths. Some have guessed that the berm was an esker, created in a tunnel under a melting glacier. Others have thought the ridge was man-made. Actually, this ridge or berm is what is known as an Ice Push Rampart.

How were these ramparts formed? The ice push ramparts along the shoreline were created by thermal expansion of ice covering Cherry Pond. A rapid temperature drop causes ice on the pond to contract, creating tension cracks. These cracks fill with water and freeze, building more ice mass. When the temperature rises, the ice expands, increasing the surface area of the ice, and exerting a tremendous force along the shoreline.

The shoreline of Cherry Pond is gently sloping and consists of mud, gravel, and rocks left over from the glacier. The ice push has slowly bulldozed this material up into an irregular ridge that we call an ice push rampart. The ramparts at Cherry Pond are 4-5 feet high, and up to 20 feet wide. Some of the rocks weigh thousands of pounds. The Rampart Path is one of the best places to see this phenomenon in New Hampshire. This 0.5-mile trail is built atop the rampart making for easy travel.

What is the geological definition of an ice push rampart? A mound of beach material that has been forced up along a shoreline by the lateral movement of floating ice. We use the term ice push rampart, but other names exist, including ice push ridge, ice shove ridge, ice thrust ridge, and walled lake.

The actual start of this formation goes back 13,600 years ago. How do we know this? We know this because that is when Carbon 14 dating indicated that Cherry Pond was formed. This was when the retreating glacier created a lake that was named Glacial Lake Israel in 1940 by Richard Lougee, a geologist. This glacial lake was many times larger than today's Cherry Pond and extended to the Riverton section of Jefferson. At some point around 13,600 years ago, the melt water created a massive spillway at the outlet of Cherry Pond. It drained Glacial Lake Israel along what is now the John's River that goes through Whitefield, NH. Incidentally, John and Israel Glines were early European settlers to the local area, and Israel and John's Rivers are named for them.

Cherry Pond is a tiny remnant of Glacial Lake Israel. Today Cherry Pond is 120 acres in size and is getting smaller due to bog encroachment. Back 13,600 years ago, it was over double that size, a basin carved by the glacier. Over the millennia, the vegetation has slowly filled in from the sides. The pond, once over forty feet deep, is now only six feet deep and continuing to fill in.

What conditions are favorable for ice rampart formation?

1. Spring is the best time of year with more daylight hours, sunlight, and frequent temperature changes.
2. A snow-free ice surface. Snow insulates the ice and minimizes the contraction and expansion. Cherry Pond is in a snow shadow created by nearby mountains, getting much less snow than Randolph or even four-miles away in Jefferson. The strong winter winds often blow the snow off the ice.

3. Ice push requires a minimum of five inches of ice thickness. Cherry Pond has been known in past years to have ice two-feet thick, but in recent years the ice has been less than half that thickness.
4. Lakes that are not small or large. The optimum size appears to be around a half-mile wide. Big lakes create what is known as a pressure ridge that pushes the ice upwards and dissipates the pressure. Small lakes do not have enough ice to create the push. Cherry Pond averages a little over a half-mile wide and is a perfect size for ice push.
5. A gently sloping shoreline that freezes to a considerable depth welding the ice to the sand, gravel, and rocks that are then bulldozed up by the expanding ice.

The image of Cherry Pond with this article is a LiDAR image (hereafter lidar). Lidar stands for light detection and ranging. Lidar uses light in the form of a pulsed laser to generate a precise three-dimensional picture of the surface of the Earth. Lidar imagery from airplanes started around 1995 and has revolutionized mapping and such fields as archaeology. The images were developed by scientists using taxpayer funding and are publicly available.

The lidar image (Fig. 1) clearly shows the ice push rampart on the west or left side of the picture. You can also see the rampart on the east or right side. The observation platform sits on the ice push rampart. The Shore Path is an excellent example too.

Is the formation of the ice push rampart still active? The answer depends on the location. At the rampart label on the image, the structure is considered to be a "fossil" rampart. It is inactive because bog mat vegetation extends outward to open water, and no ice touches the shoreline. The Shore Path Rampart and much of the eastern rampart are still active. We know this because NH Fish and Game in 2005 put in a metal post for mounting a wood duck box at the east side of Cherry Pond. The post was pushed over a few inches every year by ice movement and was finally removed.

We hope that you enjoyed this explanation of ice push rampart formation. Cherry Pond is one of the best places in New Hampshire to see it, so go out and explore the Shore Path or the Rampart Path. Little Lake Sunapee in New Hampshire is another place to see this landform. Ice Push Ramparts are common in Michigan, Minnesota, and Wisconsin. Ramparts are also found in the Adirondacks and Northeast Kingdom of Vermont.

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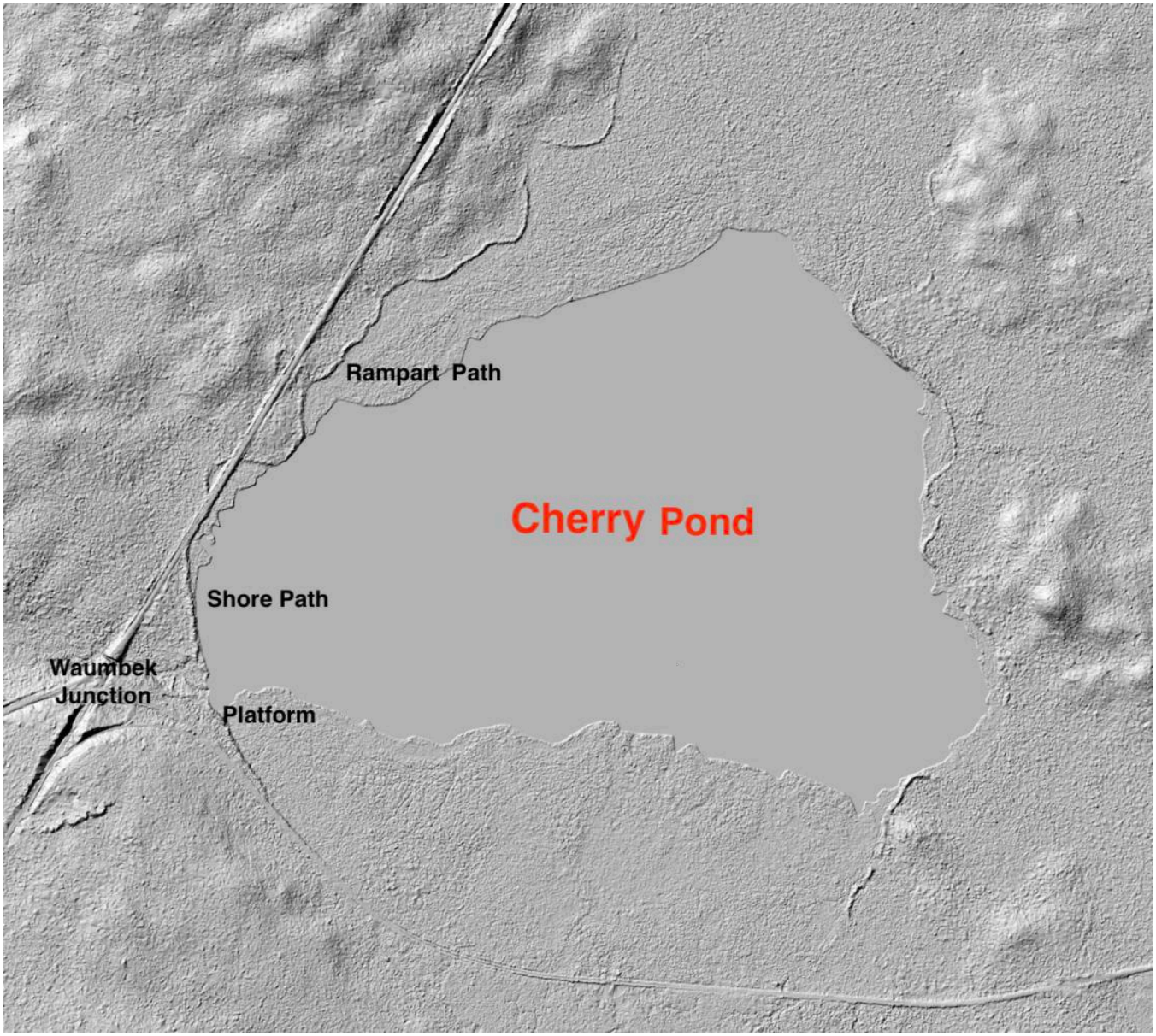

FIGURE 1. A Lidar image showing ice push ramparts as a sinuous thin line on the left or west side of Cherry Pond. The ramparts also show on the right or east side of Cherry Pond. The straight line north from Waumbek Junction is the railroad line. Notice a section of the rampart is on the left side of the rail line for a short distance between the Shore Path and Rampart Path. The Tudor Richard Observation Platform sits atop a rampart that closely parallels the rail trail. The rail trail is visible at the bottom of the image.

FIGURE 2. The Ice Push Rampart at the junction of the Rampart Path and Little Cherry Pond Trail. The rampart is nearly five feet here.

FIGURE 3. Rocks and boulders are clearly visible at this overlook on the Rampart Path. The vegetation is typically balsam fir because beavers will cut down accessible birch and aspen.

FIGURE 4. A fossil or inactive section of the rampart showing a peat mat on the left extending to Cherry Pond. The side opposite the pond side often has standing water.

FIGURE 5. Cherry Pond on 6 April 2020 showing floating islands of peat that are encroaching on the edges of the pond. The Presidential Range of the White Mountains in the background.

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