Table of Contents

Features
24 An Office with a View
Spectacular sunrises, wild animals, and good company on the summit. By Pamela Maynard.

26 One More Time for Carmie
The story of the forgotten 45th flight. By Jim Good.

30 Riding the Wave
A wave of wind over Mount Washington makes the peak a mecca for wave flyers worldwide. By Doug Sanborn.

34 From Everest to Kilimanjaro
An interview with mountaineer and filmmaker David Breashears. By Gail Jennus.

Also of Interest
40 Decline of the Ice Age and Arrival of Paleoindians in the Northern White Mountains
The People of the Land, by Richard Boisvert; Update on Glacial Studies, by Woodrow B. Thompson; New Results from Lake Sediment Cores, by Christopher Dorion

Departments
2 In My View
6 Out of the Fog
8 Summit News/
Sawdust from the Log
14 Science and Engineering
16 Weather Summary
22 Many Hands
50 Programs
62 The Weather Notebook
64 Membership
67 Museum Shops
68 The Green Flash

On the Cover
Spring snowmelt in a mountain stream (Eric Pinder).
Inset: A fox visits the summit of Mount Washington on a foggy day (MWO archives).
ongoing field work is improving our knowledge of the late-glacial history of the Israel River Valley. Several glacial moraines have been identified near Bowman in the town of Randolph. An especially prominent moraine is the tree-covered ridge that you can see looking west from Lowe's Store on U.S. Route 2 (Figure 4). Other moraines occur along the power line on the south side of the Israel Valley. The Randolph moraines probably formed at the same time as those in Carroll, Bethlehem, and Littleton. They consist of rocky debris shed from the margin of the ice sheet during a series of forward pulses of the glacier. This event is known as the Littleton-Bethlehem Readvance; it is thought to have occurred during a cold climatic interval called the "Older Dryas" in Europe, 12,200-12,000 radiocarbon years BP. (Thompson et al., 1999).

Glacial Lake Israel was dammed in the valley as the ice margin withdrew toward Lancaster. Richard Lougee (1930) outlined the history of this ancient lake in a gravel survey for the New Hampshire Highway Department. The level of Lake Israel dropped several times as recession of the glacier exposed progressively lower outlets. Meltwater rushed through an ice-walled tunnel in the base of the glacier and into the lake. Sand and gravel pouring from this tunnel built up to the lake surface in some places, forming flat-topped deltas. Elsewhere, sandy subaqueous fans and lake-bottom muds were deposited. The ice tunnel eventually became choked with gravelly sediments which now form an esker ridge on the valley floor south of Jefferson village. Portions of the Jefferson II Paleoinian site are located on these water-laid glacial lake and esker deposits.

The water body associated with each level of the ice-dammed lake is called a "stage." The earliest and highest version of Lake Israel was the Bowman stage, which drained eastward through the gap at Bowman (elevation ~457 meters) and into the Moose River. Glacial recession from the north side of Cherry Mountain allowed the lake waters to escape southwest through the Cherry Pond area into the Johns River basin. This was the beginning of Baileys stage (named by Lougee for a railroad station in Jefferson) which stood at about 338 meters. Baileys stage lasted until the ice margin retreated to the hillside just south of downtown Lancaster. At this point, Lake Israel quickly dropped to as many as three lower levels (Lancaster stages) and finally drained completely into glacial Lake Coos in the Connecticut River Valley. The outflow of the Lancaster stages cut channels into the hillside with threshold elevations of about 327, 309, and 291 meters. These closely spaced channels are located in the woods east and west of U.S. Route 3, 0.9 kilometers south of the Israel River. They probably formed within a few years of each other.

When Lake Israel dropped to the 309-meter level, a separate and slightly higher lake may have been left behind in the area upvalley from Riverton on Route 2. The Israel Valley is narrowly constricted by glacial till deposits at Riverton, which possibly dammed a small shallow lake at 318
meters. This speculative lake might have lingered into Paleoindian times before being filled with sediments or drained by downcutting of the till barrier.

We can estimate the ages of some of these glacial features based on the newly obtained radiocarbon ages from our pond sediment cores (Table 1) and other recent work in the area. The varved sediments in the lower parts of the Cherry Pond cores were deposited into the Baileys stage of glacial Lake Israel, of which the modern pond is a small remnant. Although the basal age from these cores is anomalously young, the ages of the youngest varves approximate the termination of Baileys stage. These ages are 11,480 and 11,800 BP. They fit nicely with the estimated Older Dryas age for the Littleton-Bethlehem Readvance, which formed the moraines and glacial lake deltas at Carroll. The latter deposits are a short distance south of Cherry Pond and thus slightly older than Baileys stage of Lake Israel.

The cores from York Pond in Berlin yielded two ages from the base of the glacial muds. In this type of situation we normally take the older age as being closest
to the time that glacial ice retreated from the site, *i.e.* 11,980 BP at York Pond. This age is likewise compatible with previous results from the region, especially the 12,450 BP age from Pond of Safety in Randolph, located south of York Pond and at a higher elevation (Thompson *et al.*, 1999).

The older of the two basal ages (12,360 BP) from the cores taken at Martin Meadow Pond in Lancaster is puzzling. The location of this pond (west of Weeks State Park) suggests that it would have been deglaciated about 11,900 years ago, *i.e.* soon after the Littleton-Bethlehem Readvance but prior to ice retreat from Lancaster and the termination of the Bailey Stage of Lake Israel. However, given the possible uncertainties of sampling and dating, the age from Martin Meadow Pond does not deviate seriously from regional trends. Future work will examine Lake Israel deposits near Lancaster, the history of glacial Lake Whitefield in the Johns River Valley, and the mysterious glacial Lake Coos in the Connecticut River Valley between Dalton and North Stratford.

References


New Results from Lake Sediment Cores
by Christopher Dorion

Varves (annual sediment layers) in the lower part of the Cherry Pond cores were deposited into Glacial Lake Israel. The present Cherry Pond was a basin on the floor of this late-glacial lake. We attempted to date the earliest varves, which presumably were deposited at the ice sheet margin. This would tell us when the valley became ice-free and hence suitable for occupation by Paleoindians. However, after careful sieving of the A, B, and C cores, we were disappointed to find only a few degraded pieces of organic material in the bottom varves.

From other pond cores in the area, we know that vegetation, insects, and other fauna were present at the glacier margin. The margin was receding very slowly, approximately 50 to 150 meters per year on average, during late-glacial time. Our hypothesis as to why so little organic matter became incorporated into the varves relates to how glacial meltwater discharged at the ice sheet margin.

In one scenario, glacial meltwater exited a tunnel mouth at the ice margin, flowed downslope as a stream, and then entered the glacial lake. Vegetation was periodically washed into the meltwater stream and carried out into the glacial lake where it settled to the bottom along with the clay, silt, and sand to form a varve. In contrast, in the Israel Valley, glacial meltwater discharged through a tunnel at the base of the ice sheet margin and directly into Lake Israel. Since the glacial stream dumped its sediment load directly from the ice tunnel into the lake, it could not incorporate vegetation living on the nearby hills. Perhaps small non-glacial streams could have carried material into the lake? This is not likely as there is abundant data supporting an arid steppe environment during late-glacial time; the streams so prevalent today in the White Mountains would have been dry most of the year. In Greenland today, along the ice sheet margin, only about 15 centimeters of annual precipitation falls, mostly as snow. The White Mountains average over 100 cm today with significantly higher amounts at higher elevations.

We obtained two ages from the youngest, or highest, varves in the Cherry Pond cores (Table 1). These ages suggest that the ice sheet had melted back to the northwest, out of the Israel Valley, at or before 11,800 $^{14}$C yr BP (radiocarbon years before present, henceforth abbreviated “BP”). We can still estimate the time of deglaciation because Jack Ridge of Tufts University, using a modified gray-scale imaging system, counted 90 varves from the base of the varved section of the core to the top. This suggests that glacial meltwater entered the lake for 90 years before being diverted to another valley. This would place the time of deglaciation close to 12,000 BP, in close agreement with the other evidence presented in this article.
<table>
<thead>
<tr>
<th>Site Name</th>
<th>Latitude (N)</th>
<th>Longitude (W)</th>
<th>Facility</th>
<th>Accession number</th>
<th>Age (c)</th>
<th>C-13 (d)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cherry Pond, #1</td>
<td>44 22 32.87</td>
<td>71 30 44.49</td>
<td>varves</td>
<td>PL-000045A3</td>
<td>7760</td>
<td>11.40</td>
<td>Disappearance of Israel valley</td>
</tr>
<tr>
<td>Cherry Pond, #2</td>
<td>44 22 32.87</td>
<td>71 30 44.49</td>
<td>varves</td>
<td>PL-000045B6</td>
<td>11 465</td>
<td>60</td>
<td>Drainage of Glacial Lake Israel</td>
</tr>
<tr>
<td>Cherry Pond, #3</td>
<td>44 22 32.87</td>
<td>71 30 44.49</td>
<td>varves</td>
<td>PL-000045G8</td>
<td>11 900</td>
<td>60</td>
<td>Drainage of Glacial Lake Israel</td>
</tr>
<tr>
<td>Cherry Pond, #4</td>
<td>44 22 32.87</td>
<td>71 30 44.49</td>
<td>varves</td>
<td>PL-000045Y5</td>
<td>10 780</td>
<td>60</td>
<td>Initiation of Older Dryas Illicit zone</td>
</tr>
<tr>
<td>Cherry Pond, #5</td>
<td>44 22 32.87</td>
<td>71 30 44.49</td>
<td>varves</td>
<td>PL-000045F4</td>
<td>10 720</td>
<td>60</td>
<td>Younger Dryas Illicit zone termination</td>
</tr>
<tr>
<td>Cherry Pond, #6</td>
<td>44 22 32.87</td>
<td>71 30 44.49</td>
<td>varves</td>
<td>PL-000045F8</td>
<td>10 710</td>
<td>60</td>
<td>Initiation of Older Dryas Illicit zone</td>
</tr>
<tr>
<td>Cherry Pond, #7</td>
<td>44 22 32.87</td>
<td>71 30 44.49</td>
<td>varves</td>
<td>PL-000045A4</td>
<td>10 670</td>
<td>60</td>
<td>Termination of Bolling-Allerød onset</td>
</tr>
<tr>
<td>Cherry Pond, #8</td>
<td>44 22 32.87</td>
<td>71 30 44.49</td>
<td>varves</td>
<td>PL-000045F7</td>
<td>8 440</td>
<td>60</td>
<td>Younger Dryas Illicit zone termination</td>
</tr>
<tr>
<td>York Pond, #12</td>
<td>44 30 10.09</td>
<td>71 20 14.08</td>
<td>varves</td>
<td>PL-000045A4</td>
<td>9 980</td>
<td>60</td>
<td>peak organic productivity in lake</td>
</tr>
<tr>
<td>York Pond, #13</td>
<td>44 30 10.09</td>
<td>71 20 14.08</td>
<td>varves</td>
<td>PL-0000456A</td>
<td>10 900</td>
<td>60</td>
<td>Deposition of York Pond</td>
</tr>
<tr>
<td>York Pond, #10</td>
<td>44 30 10.09</td>
<td>71 20 14.08</td>
<td>varves</td>
<td>PL-0000450A</td>
<td>10 650</td>
<td>60</td>
<td>Bolling-Allerød time</td>
</tr>
<tr>
<td>York Pond, #11</td>
<td>44 30 10.09</td>
<td>71 20 14.08</td>
<td>varves</td>
<td>PL-0000453A</td>
<td>10 680</td>
<td>60</td>
<td>onset of Younger Dryas Illicit zone</td>
</tr>
<tr>
<td>York Pond, #9</td>
<td>44 30 10.09</td>
<td>71 20 14.08</td>
<td>varves</td>
<td>PL-0000459A</td>
<td>9 180</td>
<td>60</td>
<td>Younger Dryas Illicit zone termination</td>
</tr>
<tr>
<td>Martin Meadow Pond #14</td>
<td>44 26 29.03</td>
<td>71 36 12.62</td>
<td>varves</td>
<td>PL-0000461A</td>
<td>12 380</td>
<td>60</td>
<td>peak organic productivity in lake</td>
</tr>
<tr>
<td>Martin Meadow Pond #15</td>
<td>44 26 29.03</td>
<td>71 36 12.62</td>
<td>varves</td>
<td>PL-0000469A</td>
<td>10 920</td>
<td>60</td>
<td>Deposition of Martin Meadow Pond</td>
</tr>
<tr>
<td>Carroll splitway #16</td>
<td>44 17 23.62</td>
<td>71 32 46.13</td>
<td>varves</td>
<td>PL-0000469A</td>
<td>11 430</td>
<td>60</td>
<td>Carroll splitway termination</td>
</tr>
</tbody>
</table>
For the next 1,000 years, following the demise of glacial Lake Israel, the bottom sediments of Cherry Pond were mixed to some extent by burrowing organisms. Due to the arid conditions, the lake was most likely alkaline and supported aquatic gastropods. It probably was smaller than today and hence shallower. The high silt and clay content of this section of the core reflects an open landscape with bare ground in places and wind-deposited loess (silt and fine sand). The landscape was similar to that of the Great Plains of the central United States, with trees only occurring along ponds and other wet areas. Mean annual temperatures were significantly lower than today.

Most likely, the extremes we experience today of extreme heat and humidity in summer, heavy ice and snow in the winter, and a damp, prolonged mud season did not exist. Periodically, high winds would entrain silt and fine sand from glacial outwash and river alluvium in valleys and deposit this loess as a blanket across the landscape. The silt and fine sand sections we find in pond cores during this time raise an ongoing research question: To what extent was the sediment of eolian (loess) origin? Or was the sediment deposited by water eroding the landscape?

Beginning at about 10,700 BP, an abrupt climactic cold period began, called the Younger Dryas chronozone. Its onset was rapid, as seen in the razor-sharp transition in the core from silty organic-rich gyttja back to barren gray mud. Records from the Greenland Ice Sheet show the onset occurred in 3 to 20 years (Stuiver et al., 1995). Worldwide temperatures dropped abruptly and the major ice sheets of the northern Hemisphere as well as glaciers in the southern Hemisphere expanded once again (Lowell et al., 1995). It was during this abrupt climactic change that Paleoindians moved into northern New England. We do not see any sedimentary evidence in the Cherry Pond record that glaciers advanced into the Israel Valley in Younger Dryas time.

The Younger Dryas chronozone terminated as abruptly as it started, and the Holocene Epoch began at about 10,070 BP. This is noted in the cores as a return to the organic-rich gyttja. By about 9,500 BP, the Paleoindian tradition had vanished in northern New England. Mean annual precipitation dramatically increased, and the once-open steppe was quickly closing in with the forests we know today. Where foot travel was once rapid and visibilities nearly unlimited, dense forest now covered New England, restricting travel greatly.
YORK POND, MARTIN MEADOW POND AND THE CARROLL SPILLWAY

York Pond in Berlin shows stratigraphy and chronology similar to Cherry Pond. This record confirms most of our previous interpretations in the area. York Pond is a kettle pond located on a valley wall composed of abundant glacial deposits such as eskers, fans, and end moraines. The base of the York Pond core is also composed of varves from which the basal organic material was sieved. The varve section is much shorter than Cherry Pond; the topographic setting of York Pond did not favor a prolonged glacial lake stage.

It is important to note that the radiocarbon ages from Cherry and York Ponds that bracket the onset and termination of the Younger Dryas climatic cooling event are in close agreement with records from Maine (Dorion, 1997) and maritime Canada (Stea and Mott, 1989). Also, the ages coincide with those from nearby Pond of Safety (described in Part 1). Together, this new data shows that the cooling event was abrupt and had an immediate effect upon the landscape across northeastern North America. The Paleoindians witnessed this dramatic shift in climate in the northern White Mountains and most likely witnessed its similarly abrupt termination nearly a millennium later.

The two basal ages from Martin Meadow Pond in Lancaster (12,360 and 10,920 BP) show a wide spread in ages. However, the younger sample was taken from a subsidiary basin of the pond. It is likely that during late-glacial time, some mixing of younger sediments occurred in the area where we took this set of cores. In general, the oldest age from a particular pond basin is the one most likely to reflect the true time of deglaciation.

We also cored a deep channel cut into the glacial Lake Ammonoosuc delta at Carroll. This was a spillway channel formed by drainage from glacial ice to the north (see Part 1). We probed for two days in an effort to find a buried basin that would have accumulated organic material once the channel ceased to carry meltwater. We located and cored a suitable topographic setting where sands on the channel floor contained typical late-glacial flora along with sedge, rush, and St. John’s Wort seeds. The wet channel environment provided the necessary conditions for these plants to exist. The radiocarbon age shows that the vegetation grew on the channel margins around 11,430 BP. The channel itself most likely formed several hundred years prior to this time. It briefly served as an outlet for glacial Lake Carroll just before the opening of Lake Israel in the Cherry Pond area, where we have ages as old as 11,800 BP.

References

Dorion, C. C., 1997, Middle to late Wisconsinan glacial chronology and paleoenvironments along a transect from eastern coastal Maine north to New Brunswick and Quebec. Canadian Quaternary Association Programme and Abstracts, p. 19-20.


Acknowledgements

We would like to acknowledge the assistance of many individuals and institutions that have facilitated our research over the past five years. First, we must profoundly thank all of the landowners who have graciously permitted us to wander through and often dig upon their land.

We particularly wish to thank David Govatsky and the Audubon Society for allowing us to conduct our research in Cherry Pond. Special appreciation is also due to the many private individuals in the State Conservation and Rescue Archaeology Program who contributed thousands of hours of labor toward the excavation and analysis of the site. Without their effort, the archaeology would not have been possible. Many professional colleagues have also contributed their time and effort to answer key questions. Prominent among them are Dr. Lucinda McWeney (Harvard University), Dr. Jack Ridge (Tufts University), and Dr. Brian Jones (Mashantucket Pequot Museum).

Most essential to the success of our research has been the support of Brian Fowler and the Billings Fund of the Mount Washington Observatory for providing the key financial support to obtain the radiocarbon dates so essential to this study. All of the radiocarbon dating for this project was done at the PRIME Laboratory of Purdue University.

Richard Beisvert, Woodrow R. Thompson, and Christopher Doran.