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Glacial Features of Winnipesaukee - Wolfeboro Area

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TRIP A-1

GLACIAL FEATURES OF WINNIPESAUKEE - WOLFEBORO AREA

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Introduction

The geological problems to be studied on this excursion are glacial problems. We hope to discern from detailed surficial mapping, and reasoning from deposits we see in the Lakes Region:

(1) Evidence that more than one passage of glacial ice moved over here (STOP 2).

(2) How did this ice flow and erode? Depth and direction. (STOPS 4, 5 7).

(3) Just how did it disappear? Ice depth, slope, sequence of basins uncovered (mostly STOPS 1, 3, 6, 8).

(4) Some interesting and often-neglected postglacial landforms: fans, ice-shove boulder ramparts seen along the way.

Note that you will need to listen and follow the log en route between stops, as many things are seen out the bus window. We will slow down while passing.

All of the source material is summarized and fully illustrated in "Surficial Geology of the Wolfeboro-Winnipesaukee Area, New Hampshire" by Richard P. Goldthwait (1968), published and available ($2 a copy) from the Department of Resources and Economic Development, State Office Building, Concord, N.H., 03301, complete with three colored maps. You can hardly get all the "lowdown" without it, so we will try to have copies for sale. Numbered figures below are in this "Surficial Geology of the Wolfeboro-Winnipesaukee Area" only, and we follow its two colored quadrangle maps. Bedrock summaries are older: "The Geology of Winnipesaukee Quadrangle, New Hampshire" (1941) and "The Geology of the Wolfeboro Quadrangle..." (1953) both by Alonzo Quinn, and available from the same source.

ROAD LOG FOR TRIP A-1

Mileage

0 miles Leave CONCORD north on I-93 for 17 miles to Tilton, noting as you go:

2 mi. Bridges across the shifting Merrimack River require revetment because earlier uninhibited flood-cutting rates were up to 6' per year.

4 mi. E. Concord san plain; an outwash delta into glacial Lake Merrimack.

13 mi. Thin drift over wooded hills; drilled wells average 13' of drift on hills.

17 miles Turn righ on US-3 for 9 miles to outskirts of Laconia, noting at:

1 mi. Thick sandy drift filling the valleys; washed off stagnant last ice.

4 mi. Lakes gouged by ice in preglacial valley (Fig. 1).

26 miles Turn right on Laconia By-Pass for 2 miles to NH-106 exit and turn there to the pits just to the north. Here we follow the Winnipesaukee Surficial Geologic Map (this new road is not on it).

1/2 mi. Glacial hillside channels sloping west, on our right (S).

1 mi. Same on left (N).

28 miles STOP 1 in pit of kame-delta complexes fringing Laconia. Items for discussion:

(1) The ice melted primarily downward, as shown by marginal stream gradients and increasing concentrations of stratified drift lower down, resulting in blockage of waters here. Evidence for different standing water levels, and necessity of ice contact.

(2) This area and the Brookfield-Wakefield Valleys (eastern portion of the Wolfeboro Quadrangle) were the first of six basins evacuated by glacial ice in east-central New Hampshire, so the ragged ice edge did retreat roughly northward. Evidence of meltwater channel directions and ice contact trapped deposits. (Table 2)

(3) History of the arguments in the 1930's about deglaciation.

29 Miles Return to Laconia By-Pass and go north 4 1/2 miles to Route NH-11, noting:

1 mi. Dry glacial channels on the hillsides beyond "City Line".

1 1/2 mi. Kame sand pits right and left; water down NH-11A from Gilford col channel to the northeast.

2 mi. Host of dry former channels (24 in all) at various levels diagonally down south hillslope (partly under ice?).

3 1/2 mi. Channel to the west, high across the north face of the hill (just before an underpass).

4 mi. Chute on right, cut under the ice.

34 miles Swing around right in the cloverleaf under ourselves and head south.

1/2 mi. on NH-11 to Lakes Shopping Plaza where we park.

35 miles STOP 2 on slope behind stores to see till sequence. Items for discussion:

(1) What are the two or three tills? Upper till here is loose, sandy, yellow-gray, with a podzol soil top, and shows eight ablation till (wasting ice) characteristics. Lower till here is compact, more clayey and shows eight basal till characteristics. But one characteristic is wrong here; the older till is weathered yellow, and has deep joint staining. Time of its deposition?

(2) History of two till arguments: 1968 trips. A possible solution to two views here.

(3) Lacustrine varved beds beneath and near Melvin Village; an earlier Lake Winnipesaukee? Date of this advance?

35 miles Return north on NH-11 1/2 mile to 11B and turn right (S) on it 2 mi. to 11A, noting enroute:

1 mi. Airport on left is on low sand fill or wash, characteristic of low areas without ice contact or thick terrace deposits. An earlier sandy esker lies along the north side.

2 1/2 mi. Gentle fan slope washed in late glacial times from sandy gravel deposits up-valley; controlled by topography here.

40 miles POSSIBLE STOP 3 in Gilford gravel kame pits right (W), showing for discussion:

(1) Coarser kame material high above valleys. indicating early fast moving water, (under ice?).

(2) Ice blockage of northward-running valleys yielded coarser ice-contact deposits, again showing retreat roughly northward.

(3) But material came from the north via ice and ice water streams (Table 1, upper part).

40 miles Turn left (E) on NH-11A for 2 1/2 miles. Note now at:

1 mi. Fine views left overbroadest part of Lake Winnipesaukee. Does the 196' depth of closure (bedrock threshold at Wiers) mean 196' of ice excavation in the old valleys (Fig. 1)?

42 miles Turn right (S) into Belknap County Recreation Area for

1 1/2 mile to picnic grounds. Note:

1 mi. Just beyond fence, an old "rotten stone pit" in syenite under thin till, and believed by many to be a residual spot of preglacial weathering.

44 miles Go out (E) to NH-11A and southeast 6 mi. to join NH-11.

Note at:

1 1/2 mi. This is another north-facing valley, full of rough kames, to the right (as at STOP 3).

3 1/2 mi. High early melt waters spilled over eastward where we pause (Fig. 8, detailed map) making a deep channel, hanging at this end, and showing higher ice to the north. Another channel lies uphill, right (S) of us.

5 1/2 mi. Kames (pits L) lower on slopes below channels signify lower ice surface level here (?).

50 miles Turn right (S) on NH-11 for 3 1/2 miles to roadside parking area.

54 miles VIEW STOP 4 overlooking Alton Bay. Discussion:

(1) Narrow "headwaters" of preglacial valley, right (S) as on Fig. 1, due to resistance of Belknap ring dike.

(2) Did ice erode more than 65' of rock - the depth of water below you? Drift thickness suggests a minimum average everywhere of 26 feet.

(3) Ice deepened the 6 major and 7 minor arms of Lake Winnipesaukee to straits elongated S41°E. Here the bay and striae go SSE. The ice turned.

(4) Opposite is ridge after ridge (in Wolfeboro Quad.) of rock drumlins. The 99 in all average S36E (Fig. 4).

(5) Below you left (through field glasses) are some of the many small islands bearing boulder tails built by shifting lake ice in March-April each year. (Fig. 12, 13, 14, 15)

54 miles Proceed south on NH-11 to Alton Bay 8 miles, noting in:

1 mi. Big boulders moved only a fraction of a mile, mostly, but common in ablation moraine near certain granites.

2 mi. More ice-contact kames with pebbles moved southward; late glacial waters seeking the Alton threshold. Farmington Valley (S) melted out first.

62 miles Turn left 4 miles on NH-28A up the east side of Alton Bay OR continue south 1 mi. to Alton to join route 28 north in either case. Note: Alton threshold on your right carried glacial drainage just above lake level but there is no overflow today.

Enter Wolfeboro Surficial Map.

66 miles Turn left again (N) on NH-28 for 1 (or 5 mi.) to "View Parking".

67 miles QUICK STOP 5 at bedrock overlook of Roberts Cove. This is the northwest side of the hill west of Gilman Pond (new road not on map).

(1) Glacial grooves here trend about S20E (see Fig. 3) and the rock drumlins S30E.

(2) Till fabrics nearby agree generally but the pebbles in very bottom till, next to any bedrock sloping sidewise or obliquely, seem to be twisted downslope by 10-30^{o} (Drake). Why?

67 miles Continue northeast 8 1/2 miles on NH-28 through South Wolfeboro (L turn) and Wolfeboro (R turn). Note at:

4 mi. At South Wolfeboro the NW-SE elongation of Rust Pond like 16 other ponds here. Three fourths of all lakes are S50^{o}E ± 25^{o} mostly in weak Winnipesaukee Quartz Diorite.

4 1/2 mi. Where we pause to note the ice-shove boulder spit, if visible, 200' to the right.

76 miles POSSIBLE STOP 6 at Allen-A sand pit. Discussion:

(1) This is a delta with foresets S to E, lobate, and a broad flat top. But it is dimpled with kettles so ice was near.

(2) There is no other matching delta level or shore, so what held L. Wentworth 70' higher? Wasting ice, and local ponding.

(3) This was third but not last of the 6 basins to deglaciate, for waters came east via Hersey Cemetary channel to build this delta, and it went out southeast (channels either side of Cook Pond).

76 miles Continue over 1 1/2 miles north to "College Road" Corner beyond NH-109 junction.

78 miles STOP 7 on the old (1790) Gov. Wentworth road from East Wolfeboro to Dartmouth College. Discussion:

(1) The Red Hill Boulder Train (Fig. 7A) counted on the stone walls. Methods.

(2) Lateral (compact) and longitudinal (elongate) exponential dispersal.

(3) Why does the stoss-slope of a hill concentrate erratics in some places?

(4) Total loss to Red Hill was 45' depth, more or less. We can replace all the syenite rocks and minerals to get this.

(5) Peculiarly balanced "rocking stones" on bedrock ledges. One in the woods 300' east of here.

78 miles Continue northeast on NH-28 for 6 miles to NH-171 crossing. Noting as you go:

1 1/2 mi. Sandy kame deltas (pits in foresets), 100' higher than at STOP 6. Channel (Fig. 9) is higher than 900' in elevation and one mile right (NE).

2 1/2 mi. Gravel kames at still higher levels (800-900'). This is the usual sequence consisting mostly of local material (Table 1 middle).

3 1/2 mi. Pond and swamp dammed repeatedly by beaver, amongst ice-contact deposits. Enter the Ossipee Mountain Boulder train (fig. 7B) here.

84 miles Turn right (E) for 2 miles through Ossipee on NH-171.

1/2 mi. Ossipee is on a neat pitted kame terrace formed at 680' after the esker branch (N) flowed uphill to 720'.

1 1/2 mi. Approach branch esker of Pine River esker, left (N). You are in the heart of a huge esker-kame ice-contact complex of deposits (see colored Wolfeboro map). This and similar tree-like branches in the eskers of the Ossipee Lake

quadrangle to the north are evidenced that drainage did flow south.

86 miles Turn right (SE) on NH-16 for 2 miles approaching Pine River esker (Fig. 10, you are on it). At Pine River bridge and spur railroad turn left into pit.

88 miles LAST STOP 8 in Pine River Esker at bend of Route 16. Discussion:

(1) Where was the ice surface when this formed? Hillside channels (W) and chute deposits along Youngs Brook and high kames seem to suggest 300' ice thickness over your head, and 500' ice thickness further north near Route 25.

(2) Imbrication, cross bedding, tributary Y pattern, and above all, pebble counts (Table 1) demonstrate that water flowed south - UPHILL.

(3) The same structures and continuity of internal beds say that it was all deposited at once (not seriatim as some would have, or as some eskers are).

(4) It is very coarse (3' boulders common) so energies were great and this much material could be gained only from lower dirty ice or basal till erosion.

(5) Adjacent satellite ridges are lower, finer, with swampy fosses as usual. Although the main stem of the drainage system divided in places (Round, Snake, White, and Lost Ponds) these ponds appear to be later (some kames superposed) and formed when the water flowed more slowly (sandy deposits).

(6) Open flat-top, but kettled, kame terraces could not form until ice was thin, and large lateral depressions were open to the sky. These top at 530' (E) to 580' (W), so seem to lead to a lower threshold east to Providence Lake - a later event (Table 2).

(7) Lower sand plains and fill were let down, exposed, or washed out last. Thus the typical sequence for all deglaciated valleys.

(8) This valley and perhaps ice just south of Ossipee Mountains were the last to melt out (Table 2).

88 miles Return to NH-16 and return right (N) 2 miles on NH-171, left (SW) 44 miles on NH-28, and right (W) 10 miles into Concord on NH-9; 58 miles in all, OR turn left (S) on NH-16 for 37 mi. to Rochester, and right (W) on NH-9/US-202 for 34 miles to Concord, 71 in all.