

GLACIAL GEOLOGY OF JAY PEAK QUADRANGLE

by

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(1) Introduction.

The Jay Peak Quadrangle covers the crest of the Green Mountains at the north boundary of Vermont. Its altitude rises from 400 feet in the Missisquoi Valley, on the west, to the summit of Jay Peak at 3861 feet in the northcentral part of the area. It is maturely dissected by streams into rolling low mountains covered by forest to give "Green Mountains" the appropriate name. Farms and pastures now occupy the valleys and adjacent lower slopes of hillsides. Three highways cross the mountains. In order from north to south they are: (1) State route 105, (2) Jay Peak road and (3) Hazens Notch route 58. The bedrock is metasediments of the Cambrian Underhill and Hazens Notch formations.

*n/*  
*to ski development and Montpelier center*

(2) Glaciation.

Subdued topography and rounded summits attest to glacial

overriding. Striae and till fabrics show this glaciation to have come from the northwest. Presumably it was the Burlington glaciation. However, striae in the southeast corner are N. 40° E. while four miles southwest of Richford at the western edge of quadrangle N. 40° E. striae are crossed by younger N. 45° W. of striae showing that the area was also overrun by the earlier Shelburne ice. Reports in the literature (Flint 1951\*) propose that local glaciers occupied the Green Mountains and excavated cirques on their slopes. Nothing to indicate this has been found during the present detailed survey. On the contrary evidence points to continental glaciation only. At Montgomery, five miles to the west of Jay Peak, a ledge of shist stands in the village part<sup>k</sup>. It is rounded by glaciation and bears good N. 50° W. striae. Rounded nubbins of quartz have been brought into relief by glacial erosion and have the diagnostic tail of softer material on their lee sides to show that the ice moved from northwest to southeast at this place. One half

\*Flint quotes A. L. Washburn, who also allows me to quote him as follows "I made a trip up the small southeast facing valley between Big Jay and Jay Peak. The contours on the map are not representative in that the valley is much more bowl shaped than indicated, and the slopes below Jay Peak are steep enough to be a headwall. There were so many trees that it was very difficult to get a comprehensive view of the situation, but I was sufficiently impressed to think that there had been a cirque glacier here, although not necessarily subsequent to the last ice cover. Striae on top of Jay Peak are N. 35° W to N. 55° W. (Personal communication 1965)

mile farther west striae and roche moutonees show ice from the northwest, and a mile farther west of this latter place striae N. 40° W. and lunar shear cracks likewise show ice from the northwest. If ice had radiated outward from the Jay Peak Mountains it could not have crossed this area without destroying the evidence of glaciation from the northwest.

#### Till.

The area is covered by till. It is thin to absent on Mountain tops but present on slopes. Where exposed along highways and borrow pits it is silty sandy basal till of mostly local origin. Till fabrics (Figs. 00) show it to have been emplaced from the northwest and therefore presumably of Burlington age.

#### Gravel.

Kames and kame terraces are widely scattered within the area. In the upper parts of tributary valleys small areas of kames are not uncommon and kame terraces flank the bigger streams in many places. Montgomery Center and Hutchins on Trout River

have kame terraces. Richford and Kents Mills on the Missisquoi River have kame terraces. Taylor Branch and Cools Brook at the west edge of the map have kame terraces, and North Branch of Lamoille River, at the south edge of map, is flanked by kame terraces. These kame terrace deposits show that the glacier here waned as stagnant blocks of ice in the valleys.

#### LAKE SEDIMENTS

##### a) Clay and Silt.

The lower part of Trout River valley as well as the Missisquoi Valley is lined with terraces composed of silty clay and silt. Here and there patches of lake sand and pebbly lake sand lie upon these terraces.

##### b) Shore-line Deltas.

#### 1120+ foot lakes.

Four widely-scattered deltas at about 1120 feet altitude are found in the area. The flat tops in each case show horizontally

bedded topset gravels lying on dipping foreset gravel deposits with amplitude of bedding ranging from 30-40 feet to as much as 100+ feet.

1) In the north branch of Lucas Brook  $1\frac{1}{2}$  miles east of East Richford, stands a delta with flat top of gravel at 1080-1100 feet in altitude. The foreset bedding in this delta is composed of uniform medium-sized gravel dipping northward with amplitude of 40-50 feet. In the northern part of the gravel pit which exposes this material, the foreset bedding is seen to lie on varved silt and clay lake sediments 8-10 feet thick. A quarter mile south of this delta, beach ridges of coarse gravel stand at 1120-1140 feet in altitude.

2) In Black Falls Brook,  $2\frac{1}{4}$  miles northeast of Montgomery, stands another flat-topped delta at 1140-1160 foot altitude.

An excavation into this gravel deposit reveals the structure.

A mile to the northeast of here, parallel to the road, stands

a bar of beach gravel at 1140 feet in altitude.

3) In the valley of South Branch of Trout River 4 3/4 miles

south of Montgomery Center is found a third delta with top

at 1120 foot altitude. The foreset beds of this delta have

an amplitude to their north dip of 65-70 feet and rest on

well-laminated silt and clay lake sediments which in turn, in

the northern part of the big gravel pit, lie on kame gravel.

4) One mile southwest of Belvidere Corners, in the south-

central part of the quadrangle near the head of the North

Branch of Lamoille River, is a beach ridge 1140 foot altitude

extending 1/2 mile to the southeast and curving to the northeast

as a hooked spit. At the distal end it stands 15 feet above

a wide swampy area underlain by pebbly lake sand. An exposure

in the end of the ridge shows three feet of fine gravel on 12

feet of fine lake sand. The road cut near the proximal end

exposes horizontal layers of lake sand and silt crossbedded,

capped by fine clean beach gravel, in places unconformable on

the lake sands and silts. (Photos, Fig. 00)

5) North of Belvidere Corners, about  $1\frac{1}{4}$  miles, a gravel terrace stands 20 feet above the swamp at headwaters of North Branch.

The surface of the terrace stands at about 1175 foot altitude.

A cut reveals 8 feet of fine horizontal gravel on 5-10 feet of fine white lake sand. It may well be that this deposit is a shore-line deposition of an early phase of the 1140 foot lake.

6) Near the western margin of the quadrangle, three miles south of East Enosburg, on the west slope of Cold Hollow Mountains, is another well-developed and well-exposed delta, capped by beach gravel at 1100-1120 foot level. Two pits in it at about the 1000 foot level expose foresets with 50 feet amplitude with lake sediments below.

#### 740-760 Foot Lake.

1) At East Richford, where Missisquoi River enters Vermont from Quebec, stands a delta along the international boundary.

Good exposures along the highway leading eastward from East

Richford show deltaic foreset gravels with amplitude of bedding <sup>a/</sup>  
 30 feet or more resting on varved clay and silt. The top of  
 the delta is at 740 feet altitude <sup>+d</sup> as shown on the topographic  
 map. This would be the delta of Lucas Brook into a 740 foot  
 lake.

2) Also on the southeast side of Missisquoi Valley  $1\frac{1}{2}$  miles  
 to the southwest, at Stevens Mills, stands a delta at the mouth  
 of Mountain Brook. A new highway cut exposes foreset gravel  
 bedding dipping out into the valley. The top of the delta  
 stands at 760-765 feet according to the topographic map. Mount-  
 ain Brook has cut a deep valley through the delta and Stanhope  
 Brook, has trimmed its western edge to leave a striking inter-  
fluvial of gravel, as sharp as an alpine ~~arête~~, between Mountain  
 and Stanhope Brooks. The toe of the delta rests on the ice-  
 contact gravel of a kame terrace in the Missisquoi Valley.

3) In the northern outskirts of Richford, just south of the

Country Club road a large gravel pit on the west slope of a big gravel terrace exposes foreset bedding of a delta with amplitude of the bedding 50-60 feet. The top of the foresets is at 640 foot altitude, but the land surface slopes upward from here to over 700 feet at the top of the terrace. A smaller terrace of gravel stands at 600 feet on the northward slope of the larger terrace.

4) Two miles south of Richford stands another 740 foot delta where the small stream outlet of Guilmettes Pond enters the Missisquoi Valley. Foreset bedding of at least 75 foot amplitude is seen in a large gravel pit.

5) The valley of Alder Brook at South Richford contains a patch of beach gravel and beach ridges at 760 foot altitude.

6) Two miles south of Montgomery Center the south Branch of Trout River displays delta levels at 720 to 740 foot ~~levels~~ dissected and redeposited to make a flat delta top at the

~~at the~~ 600-630 foot level. Good beach gravel deposits are seen in a new excavation for basement at 625 feet. Our topographic map is none too trustworthy here but it looks like water planes about 720-740 and 600-625 feet altitude in this locality.

7) Several patches of beach gravels on shore-line terraces are seen in the Trout River Valley between Montgomery Center and East Berkshire, at its mouth. One of the best displays is seen one mile north-northwest of Montgomery Center where 50 feet of small clean beach gravel is seen to lie on 25 feet of varved lake silt and clay. The beach gravel forms a flat-topped terrace at 600 foot altitude resting sharply against the bed rock valley side. Here, then we have a good shoreline at 600 feet in altitude.

8) Finally to the south and southwest of East Enosburg along west edge of the quadrangle kame terrace gravels are overlain by what appear to be beach gravels at 740 feet in elevation.

Correlation.

(1937)  
 If we follow Chapman's terminology we might designate the  
 740 foot lake as the Coveville and the 600 foot lake as the  
 Fort Ann stage of his ice-dammed lake sequence. Shorelines of  
 these two stages are found in the Enosburg Falls quadrangle.  
 There are good terraces of beach gravel at 500 feet with fossils  
 found just below this level, showing them to be of Champlain Sea  
 age. The 1140 foot lake which must have been dammed by an ice  
 margin standing at least 10 miles north of the Canadian border  
 to allow the lake waters in the Missisquoi valley to be joined  
 around, the north end of the Green Mountains, with those in the  
 Enosburg quadrangle. It may be the lake named, long ago, by  
 Hitchcock (1906) "Glacial Lake Memphremagog". Other finds in the  
 Memphremagog area may confirm this correlation.

Bibliography

## Jay Peak Quadrangle

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