GLACIAL GEOLOGY OF THE IRASBURG QUADRANGLE

by
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1966

Introduction

This quadrangle lies along the international boundary on the east flank of the Green Mountains. It is underlain by metasediments of early paleozoic age with strike N.E. - S. W. The folded rocks are intruded by Devonian granitic plutonics. Two major streams have eroded valleys into the bedrock. The Missisquoi flows northward, in the western part, 20 miles from Lowell to North Troy. Black River crosses the southeast part through Irasburg and Coventry. To the west of the Missisquoi rise the Green Mountains to 3800 ft. at Jay Peak. Between the two valleys lie the Lowell Mountains at 2600 ft. descending gradually northeastward to Lake Memphremagog at 682 ft. altitude. The topography is controlled by the lithology of the bedrock as well as its structure. Siliceous schists resist erosion and stand as uplands whereas phyllitic and calcareous

schists have been reduced to lowlands. The massive plutonics stand as hills and mountains.

Glaciation

Till

Till mantles the whole area; thin on the uplands with innumberable rounded ledges of bedrock projecting through, and thicker in the valleys. It is a buff colored silty till for the most part, through east and north of Newport Center it has a more clayey composition probably from admixture of overridden lake clays. The till is mostly basal till, dense and compact, also known as emplacement till. In places, however, such as the southwest corner of the area the till is loose, sandy without silt and clay and is thought to be ablation till.

Gravel

Kames and kame terraces abound in the area. In the Missisquoi valley kames occupy the Eden Notch, at the south margin of the quadrangle, near the headwaters of the river. To the

north Lowell is on a large kame terrace, as is also Westfield. Troy lies at the south edge of a mile-long area of kame moraine. The Black River is flanked by kame terraces from the south border of the quadrangle northward for 3 miles, and again a mile east of Irasburg. A large kame moraine area of gravel lies two miles northwest of Irasburg. Kame terraces occur to the east and north of Coventry, and a two mile area of kame moraine occupies the headwaters part of Mud Creek two miles south of Newport Center. These deposits of gravel have long supplied large amounts of gravel for construction purposes. Active pits display the structures of the gravel deposits.

Waning of the glacier

Stagnation

No evidence has been found of belts of drift which could be attributed to halts in the ice margin during waning of the ice.

On the contrary there is abundant evidence of stagnation during the dissipation of the glacier. Kame terraces occupy the valleys and many are seen on upland shoulders such as those two miles east of Troy and one mile east of Irasburg. A striking bit of sculpture, produced by a plunging torrent of meltwater which cascaded down between a cliff of bedrock and a mass of stagnant ice in the valley is seen 1½ miles northeast of North Troy on east slope of the hill, as semicircular potholes eroded into the face of the cliff. They look like vertical grooves 8 feet across and 4 feet deep and maybe 15 to 20 feet high. (Fig. 00) The other half of the pothole must have been in the stagnant mass of ice. If the ice had been moving, such a phenomenon as we see would not have been formed. Such holes eroded by plunging meltwater streams are well-known in the Alps and called moulin or glacial mills.

A small esker is seen in the Calkin pit, 3 miles southeast of newport center. It is about ½ mile long and 50 ft. high. It has a core of pea-size gravel over which is draped a blanket

of coarse bouldery gravel. The core gravel has been intimately faulted.

Two glaciations

(1) Burlington. The last glacial advance of the area which left the surface till came from the northwest as shown by the till fabric orientation (Fig. 00) as well as by the many glacial striae both within the quadrangle and in adjacent areas including Canada to the north and northwest. This late glacial advance from the northwest doubtless correlates with that designated the Burlington. (Stewart 1961, Stewart and MacClintock 1964)

(2) Shelburne. A mile southwest of Westfield a ledge of bedrock in the valley lowland projects about 10 feet above surrounding lake sediments. On its northwest side there are well-developed striae and glacial grooves N. 30-35°W. and crossing the schistosity of the rock. On the northeast slope of this roche moutonnee appear glacial grooves, likewise crossing

shistosity, bearing N. 30-35 E. It is a tenable hypothesis that these latter were made by the earlier Shelburne ice advance which were not destroyed on the lee slope of the ledge by the overriding Burlington glaciation.

Balanced Rock. Three miles northwest of Lowell at the 1500 foot contour on the east slope of the Green Mountains is a spectacular display of glacial action. (Fig. 00) It is a big glacial eratic, 5x10x10 feet in size, of serpentine precariously perched on a protruding ledge of schist bedrock. One end of the big eratic rests on two boulders, about a foot in diameter, between which are visable glacial grooves and striae, on the bedrock, which trend northwest showing that the big boulder was brought to this resting place by Burlington ice from the northwest. However, there are no outcrops of serpentine to the northwest of this place, whereas there are such outcrops 5 or 6 miles to the northeast of here. (See Geological Map of Vermont, 1961) It is therefore logical to propose that

this boulder was carried first by the Shelburne ice toward the southwest and later brought by the Burlington ice southeastward to its present resting place.

Adjacent areas. The Memphremagog quadrangle to the east contains striae and till fabrics from the northeast as well as those from the northwest. The Jay Peak quadrangle on the west displays northeast striae near the northeast base of Belvidere Mountain, and three miles southwest of Lowell, and numerous Burlington striae and till fabrics. The Hardwick quadrangle to the south likewise contains both striae and till fabrics of Shelburne and Burlington glaciations. Therefore there is good evidence to demonstrate two glaciations of the Irasburg quadrangle.

Lake Sediments.

During the waning stages of the last glaciation of the region ice-dammed lakes occupied the valleys, as shown by lacustrine sediments. This sediment consists of clay, silty

clay, silt and sand. In many places the clay, silt and sand is well enough laminated between coarse and fine layers to be known as varved clay. An exposure of such varved clay 15 feet high is seen along the highway on north side of Mud Creek a mile and half northwest of Newport Center. This silty clay forms terraces in the Mud Creek valley between Newport Center and North Troy where they merge with similar terraces of the Missisquoi valley. In the region of North Troy the surfaces of the terraces are commonly composed of pebbly sand with silty clay exposed on the lower slopes of the terraces. This pebbly sand caps terrace remnants all the way to the south edge of the map. Similarly in Black River valley lake sediment terraces of clay, silt and sand are found from Coventry south to the edge of the map. The presence of pebbly sand on the surface of the terraces suggests wave transportation during shoaling stage as the lakes were drained. Striated boulders are found in the lake silts at many places showing

them to have been rafted to their present locality in icebergs calved from the ice edge to the north which was damming the lakes. One quarter mile southwest of Coventry many such boulders are seen in road cuts and on surface of silt terraces. In places, fields are strewn with these boulders left by erosion of the silt. Auger borings show that these boulders lie on silt to the 4 ft. depth of the auger at least. Similar silt lake sediment terraces, both north and west of Newport (just east of Irasburg map) show innumerable ice-rafted striated boulders in excavations for wells and for basements of new houses. This occurrence shows that the lakes were ice-dammed and that at least part of the sediment was derived from the ice margin to the north.

Erosion.

The lake sediments are unconsolidated, of course, and are easily eroded by streams and slopewash. As a result in postglacial time before vegetation stabilized the slopes the

lake sediment was extensively dissected to expose the under lying glacial drift and also ledges of bedrock. Where lake sediments buried kame-and-kettle topography of kame moraine areas, undrained areas were filled with sediment and later cut into dendritic stream patterns exposing silt, clay,sand and gravel in a bewildering pattern. However, there are many places where the kettle holes of the kame areas were not filled and today contain kettle lakes. Smith Pond and Sargant Pond, two miles southeast of Newport Center; Cotter Pond, two miles southwest of Irasburg are good examples. Since these ponds are below the level of surrounding lake sediments, they could only have remained unfilled because the ice block which formed them was still present during the lake episode, and melted out only after the lake episode was over. Lake sediments in, and flanking, ice-block depressions are much faulted, accomplished as buried ice blocks melted out. (Fig 00). We would think then of the lake episode as of relatively short duration.

Lake Levels.

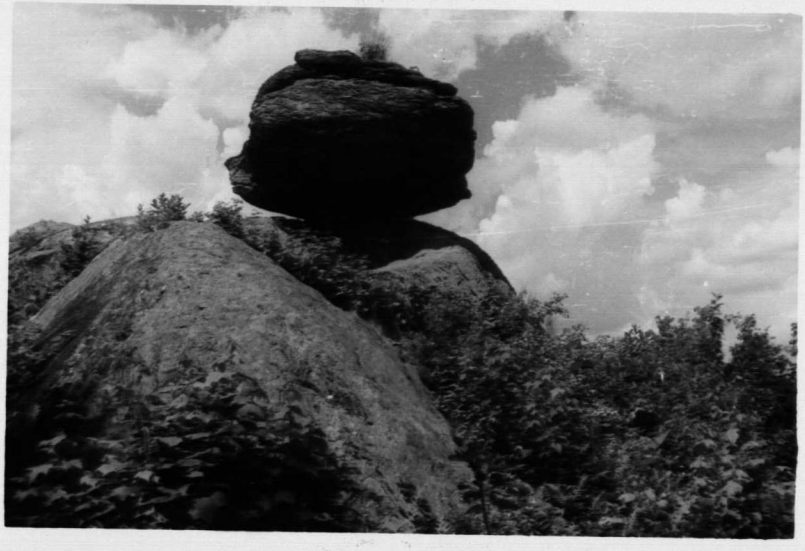
Shore-line features are the most significant ones to establish lake levels. Beaches, wave-built horizontal beach ridges and gravel bars are very useful evidence, but tops of deltas in this area have proved to be the best evidence since they are easily recognized among other gravel and sand deposits. Two such deltas are found in this quadrangle. One, in the Black River valley 4 miles southwest of Irasburg on the east slope of the Lowell Mountains, 1 mile west of Brown School, stands at 1140 feet altitude by the map contours; the second delta, which is two miles southwest of Westfield in Taft Brook on west valley slope of Missisquoi Valley also stands with its top at 1140 feet altitude. These two deltas have typical lobate pattern and foreset bedding of the gravel with amplitude respectively of 80 ft. and 40 ft. (Figs. 00 and 00) A well-formed gravel beach ridge about ½ mile long is seen 4 miles south southeast of Westfield east of Missisquoi River in the

valley of Mineral Spring Brook. Its altitude is likewise 1140 feet. Where Hazen Brook, 1.7 miles north west of Lowell, issues from its deep narrow ravine into the capaceous Missisquoi Valley it has deposited deltaic gravels with flat topset gravel at 1060 feet according to the map. Two lobate levels to the east stand at 1000 feet and 980 feet. This delta seems to have accumulated during a lowering stand of the high lake. Here then is convincing evidence of a lake level at the present altitude of about 1140 feet.

Below this level remnants of lacustrine sediments are to be found in all the valleys. Certain lake features at lower levels may be mentioned as part of the lake history. A gravel pit in the valley slope of a flat-topped terrace, 1 mile south of Lowell, exposes a face of 60 to 70 feet high showing a deposit of pea-sized gravel 30 feet thick with foreset delta bedding dipping eastward out into the valley. This deltaic deposit is overlain by 15 feet of fine horizontally-stratified

Trasbourg

Looking east across Trasbourg Quadrangle from the crest of the Green Mountains.



Balanced Rock 3 miles northeast of Townsend.
1500 ft. A.T.

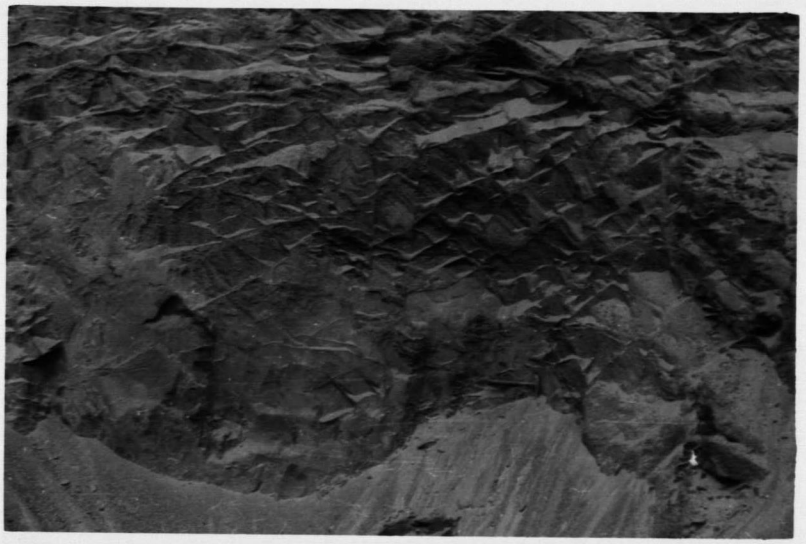
Trasberg

semi circular pothole, 1½ miles northeast of North Troy.

1140 ft. delta 4 miles southwest of Trasberg, Lamphear Brook

Trasberg.

Small cabin 1 mile south of Powell.



Crystal Lake Campground 2 miles
south of Newport Station