

Glacial Geology of the Burke Quadrangle

by

Paul MacClintock

Introduction.

The Burke Quadrangle lies in the northeastern part of Vermont about 18 miles south of the Canadian border and 12 miles west of the New Hampshire border. It is a rolling upland area with its central part composed of a northeast to southwest string of mountains with Kirby Mountain: 2600 feet, Burke Mountain: 3200 feet, and Umpire Mountain: 2900 feet in the southern part; and East Haven: 2900 feet and Senica Mountain: 3000 feet, in the northern part. West Branch and East Branch of Passumpsic River have cut deep valleys down to the 700 foot level in the western part of the area whereas the eastern part, which is drained to the Connecticut River, remains high. The bedrock consists of the Devonian metasediments of the Waites River and Gile Mountain formations as well as the Ordovivian Albee formation, all intruded by undifferentiated granitic plutons. Selective erosion of the

less resistant rocks has left the more resistant (silicious and massive) ones standing high.

### Glaciation.

#### Till.

The area is covered with a mantle of till. It is mostly ablation till of loose sandy nature, though basal till is found at bottoms of many valleys and a few spots on uplands. It is a gently undulating blanket a few to a dozen feet thick with ledges of bedrock projecting through it. In some areas, however, it is found to have frontal morainal topography and is presumably a score or more feet in thickness in these places. One such area of about a square mile lies northwest of West Burke and another is on the uplands a mile southwest of West Burke. A well in this latter area penetrated 40 feet of drift before hitting bedrock. Another patch covers the southern three miles of Bemis Hill west of East Burke. Two other areas are seen in the northcentral part of the

quadrangle; near Newark Hollow and East Newark.

Gravel.

The east and west branches of Passumpsic River are flanked by kame terraces for almost their total lengths. An area of kame terraces in Mill Brook occupies the lower slope of Umpire Mountain, and an area of kames occupies Moose River Valley at the southern margin of the quadrangle.

A striking display of eskers occupy the valley bottoms of both the east and the west branches of Passumpsic River. The latter extends southward  $6\frac{1}{2}$  miles from West Burke to the northern outskirts of Lyndonville where it is joined by the esker in East Branch valley which begins at East Haven,  $9\frac{1}{2}$  miles to the north. After joining, the esker continues southward through Lyndonville, where it is largely buried by lake sediments, and along Passumpsic valley to and beyond St. Johnsbury; a total length of at least 25 miles from East Haven to its southern end. The crest of the esker,

of course, is not horizontal but undulatory, its width varies <sup>varying</sup> from 20 or 30 feet to a hundred or more, and its height above its base likewise varies from a dozen to 80-100 feet. (Fig.

00) It is composed of a core of medium to fine gravel overlain by the usual blanket of coarse bouldery gravel. Many of the boulders are as large as 3 x 4 x 5 feet in size. Many of them likewise are well striated. In both tributary valleys the esker is flanked through much of its length by kame terraces on one or both sides. In many places, however, the flood plain of the river abuts against its lower slope of the esker.

#### Lake Sediments.

In Passumpsic Valley there is much lake sediment of clay silt and sand. Southward from West Burke and also from East Burke there are terraces of this material. Just east of Lyndonville there is such a terrace about  $\frac{1}{2}$  mile wide

by 3 miles long. Here Lily Pond is in a pothole left by  
the melting of an ice block which outlasted the lake episode.

The lake sediments have been dissected into fluvial topography by postglacial stream erosion. Wind has blown the sandy sediments into dune topography west of Egypt along the western edge of the quadrangle.

#### Shore-line.

The highway up the south end of Bemis Hill, shows, in a fresh excavation, kame gravel up to the 800 foot level overlain by 35 feet of horizontally-bedded fine lake sediment of silt and sand. This is capped by 3 feet of clean sharp beach sand and gravel which is cross bedded with 5 or 6 inches of amplitude. Here, then, we have the shore of the lake at 840 feet altitude. (Fig. 00).

#### Two Glaciations.

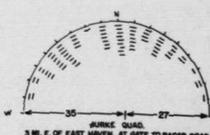
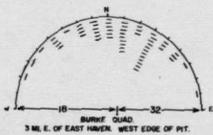
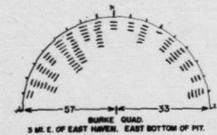
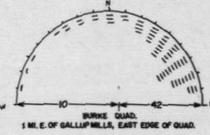
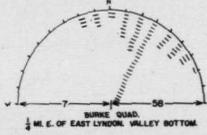
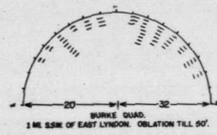
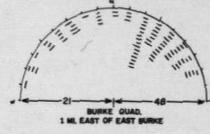
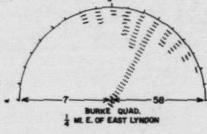
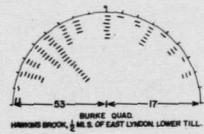
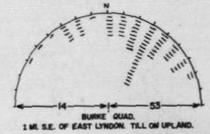
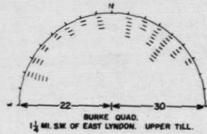
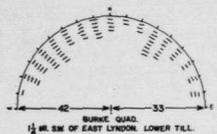
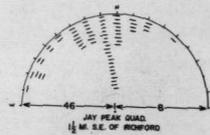
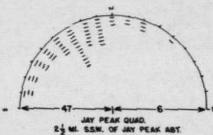
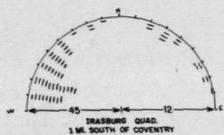
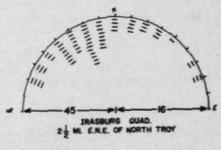
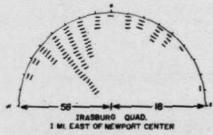
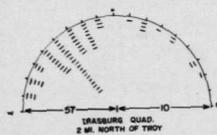
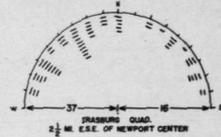
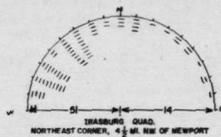
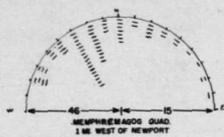
In the valley of a small tributary to Passumpsic River,

named Sheldon Brook and Hawkins Brook, in the southwest corner of the quadrangle, thick drift is exposed by undercutting the south side of the valley. The woods have been stripped away in four places to lay bare the glacial drift. (Fig. 00)

Two tills, outwash and lake clays are found. At section 1, a lower till has fabric from the northwest whereas an upper till has fabric from the northeast. This is likewise true of section 3. Sections 2 and 4 show only till with northeast fabric. This occurrence then shows an earlier glaciation from the northwest and a later one from the northeast. These two episodes were separated by lake history as shown by considerable thickness of varved clays seen in section 3. (See fabric diagrams Fig. 00) By correlation with the Stannard Brook type section, (Stewart and MacClintock 1964) the till with northwest fabric (maximum about  $N.35^{\circ} W.$ ) would correlate with till "A" and that with maximum from northeast would be till "C" or Shelburne.

At the crest of the north end of East Haven Range 2 miles east of East Haven at about 2100 feet in altitude a borrow pit for the access road to the Radar Station displays basal till on bedrock. At the east rim of the pit the fabric is N.W., whereas in the bottom of the western part of the pit we get a good northeasterly fabric. Also in the western part of the pit the till lies on striated bedrock clearly showing earlier northwest striae crossed by younger northeast striae. Elsewhere in the quadrangle there are abundant N.W. striae and many northeast till fabrics. (see map) We therefore have good evidence that the quadrangle was crossed first by ice from the northwest and later by ice from the northeast. A lake episode intervened between the two glaciations. Since this area lies beyond the edge of Burlington glaciation (Stewart and MacClintock 1964) the northwest drift is either till A or till B. The northeast glaciation is probably the Shelburne glaciation.

The neighboring quadrangles, Lyndonville to the west, and Littleton and St. Johnsbury to the south and southwest, also display an earlier glaciation from the northwest and a younger from the northeast. It might not be amiss to predict that these two glacial episodes will be found to cover much if not all of New England.



(29.00)

Jay Peak -

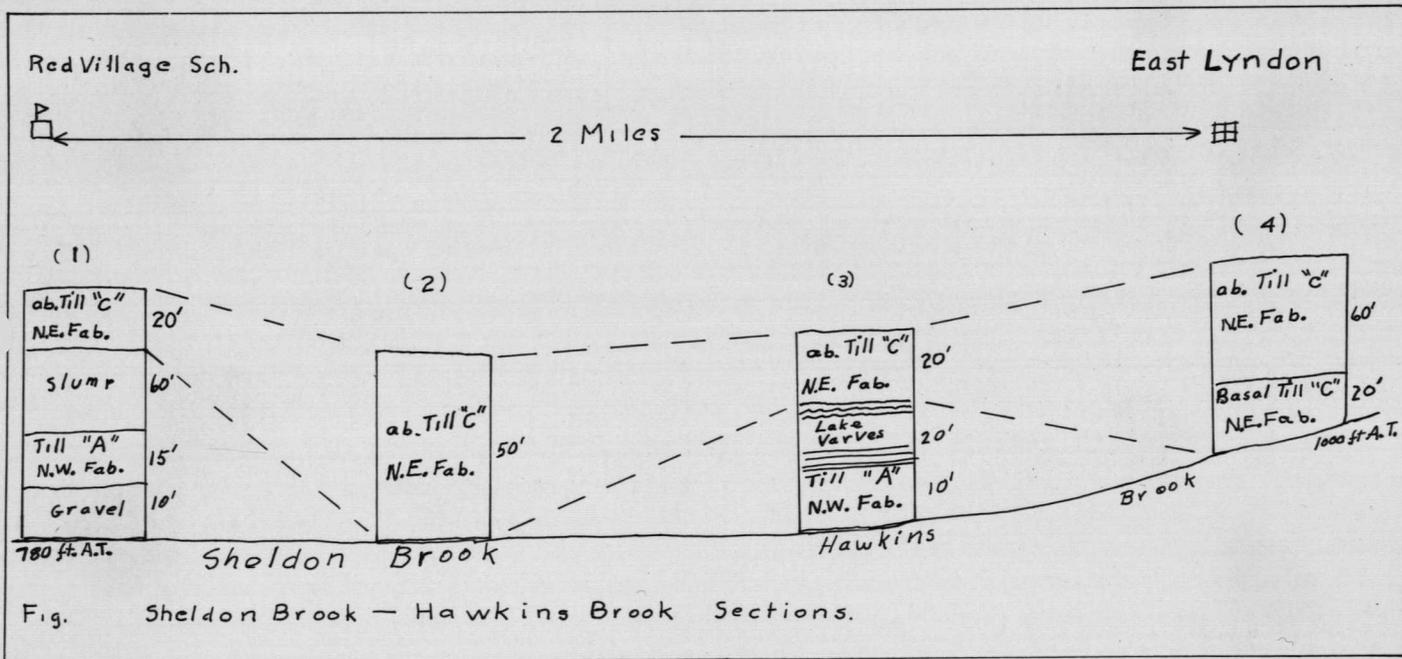


The 760 ft. Dalters at Stebens Mills,  
Jay Peak Q.



The 740 foot and the 600 foot Dalters levels at  
at Hutchins, Jay Peak Quad

Rucke



(7900)

direction of drill - 4?  
Rochraft

Bourke



Beach gravels, at 840 ft. altitude, capping  
lacustrine sand and silt. 2 mi. N.E. of Lyndenville



Lake sediments 2 mi. N.E. of Lyndenville