

GLACIAL GEOLOGY OF NORTHEASTERN WHITEHALL QUADRANGLE

## INTRODUCTION

Location: That part of the quadrangle within the state of Vermont covers a strip of country about, 14 miles north-south by 8 or 9 miles east-west, lying between the west edge of Castleton Quadrangle and the valley of the Lake Champlain outlet, and Poultney River.

Topography: It is a terrain composed of low gentle hills, 600-800 ft in altitude, rising above broad gentle lowlands, 200-300 ft. above sealevel, which are floored by 100 ft. or so of lacustrine sand, silt, and clay. This latter, easily eroded material, has been dissected by post-glacial streams into mature dendritic topography.

Bedrock: As shown on the State Geologic map, the bedrock consists for the most part of metasediments of Cambrian and Ordovician age, but the core of the north-south Austin Hill, in the western part of the area, just north of Whitehall, is made of pre-cambrian gneiss flanked by the paleozoics, and stands as the most conspicuous feature of the region.

## Glaciation

The area has been completely glaciated. The uplands are

strewn with till, which forms an irregular and discontinuous blanket of material on the bedrock which projects as bare ledges in pastures and hillsides. Some such rock exposures are conspicuous enough to have been given names such as "The Great Ledge", "Porcupine Ridge," and "Bald Mountain." But elsewhere innumerable smaller rock ledges project above the till blanket, which commonly occupies depressions.

Striae. Quite a number of well-preserved striae are found within the quadrangle (see map for details and locations). Three miles east of Benson striae were measured N.10°E, and M.20°E. A mile S.E. of Benson the readings were N.20°E and N.25°E. But a mile north of Benson good clear striae measure N.10°W. and N. 20°W. Two miles N.W. of Fair Haven striae measure N. 20°E again. Finally, at the "Ranny Rocks", where the bridge crosses Poultney River a mile west of Fair Haven, the over-burden of lake sediments has evidently been stripped off by flood waters to expose a magnificent display of glacial striae, glacial grooves, crescents, gouges, shear and tension cracks and the all-pervasive glacial polish. Some of the grooves are 5 ft. deep, 10 ft. wide, and 100 or more ft. long. The axes of the grooves all bear N.20°E as do also the great

majority of the striae. However there are scattered sets of parallel striae that bear well-displayed direction of N. 10°W, and in several places are seen clearly to cross the obviously older N.E. striae. These younger striae are seen either to descend into the N.E. striae, scratch the bottom of them and rise to the other side before continuing, or are seen to "bridge" across deeper parts of the N.E. striae before impinging on the "far bank." The display here is one of the few places in the experience of the author where evidence is completely convincing as to which set was older and which younger. (Fig. 00) It is evident therefore that here the N.10°W ice movement of the Burlington glacial lobe crossed the older N.20° E movement of the Shelburne glaciation. In this area, then, the N. 20°E striae elsewhere in the quadrangle may logically be assigned to the Shelburne glaciation and those from the Northwest to the Burlington glaciation.

Till. Similarly, the till fabrics show two directions of emplacement and indicate two tills in the region. The large highway road cut a mile N.W. of Fair Haven displays 15 feet of bouldery, cobbly

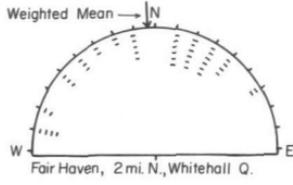
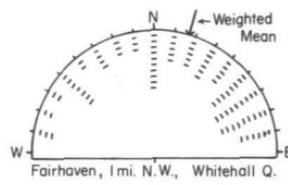
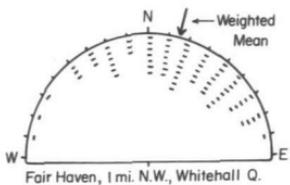
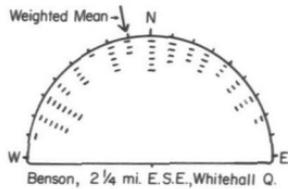
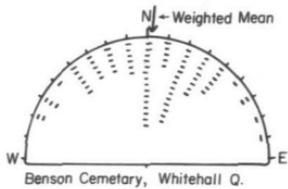
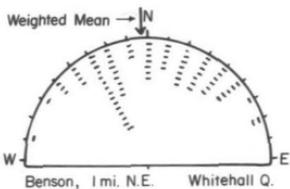
till which yields fabric whose weighted mean maximum is N 15°E and a second fabric made later gave the maximum at N.17°E, signifying the drift here to be the Shelburne drift. But the fabric of the till in a big road cut 6 miles north of Fair Haven gives the maximum at N. 10°W and indicates it to be the Burlington Drift. A third fabric at the Benson cemetery in the North central part of the quadrangle gives weighted mean maximum at N. 3°W, and across the road N.3° E., showing that ice here came from about the North direction and the evidence is not conclusive as to the age of the drift. Likewise the fabric of a road cut in New York State 4 1/2 miles N.N.W, of Whitehall is about  from the North and hence not diagnostic of age, even although the nearby striae are N.20°E and suggest Shelburne ice movement.

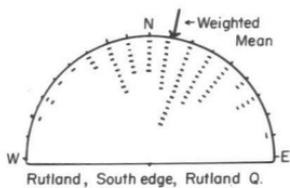
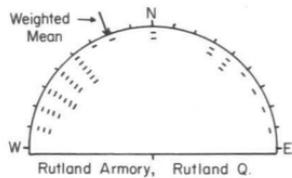
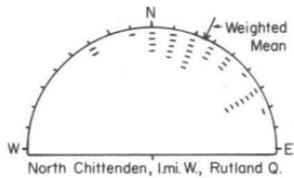
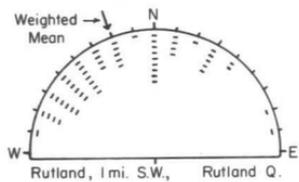
If the Burlington ice lobe followed southward in the Champlain depression as well as spreading eastward over the Green Mountains, its central axis might well have a north-south direction and deposited till with N-S maximum orientation, whereas till on the eastern margin of the lobe would show Northwest maximum and

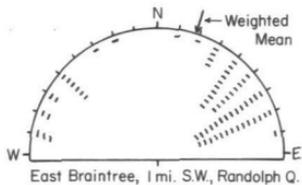
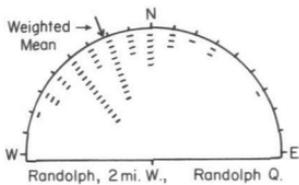
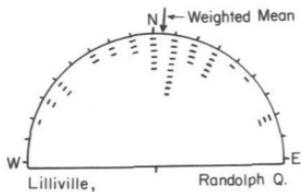
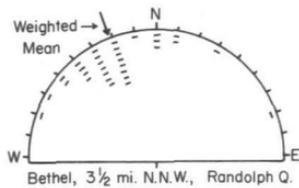
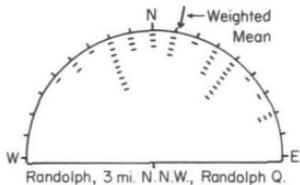
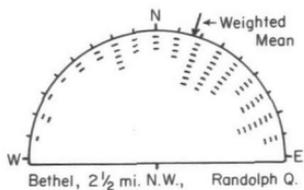
and that at the western edge of a Northeast maximum. This concept injects complication into the interpretation of the Northeast striae and fabrics at the very western edge of Vermont and the possible western edge of a Burlington ice lobe, for here the N.E. striae and till fabrics might be either Shelburne or Burlington in age, and criteria of differentiation remain to be discovered.

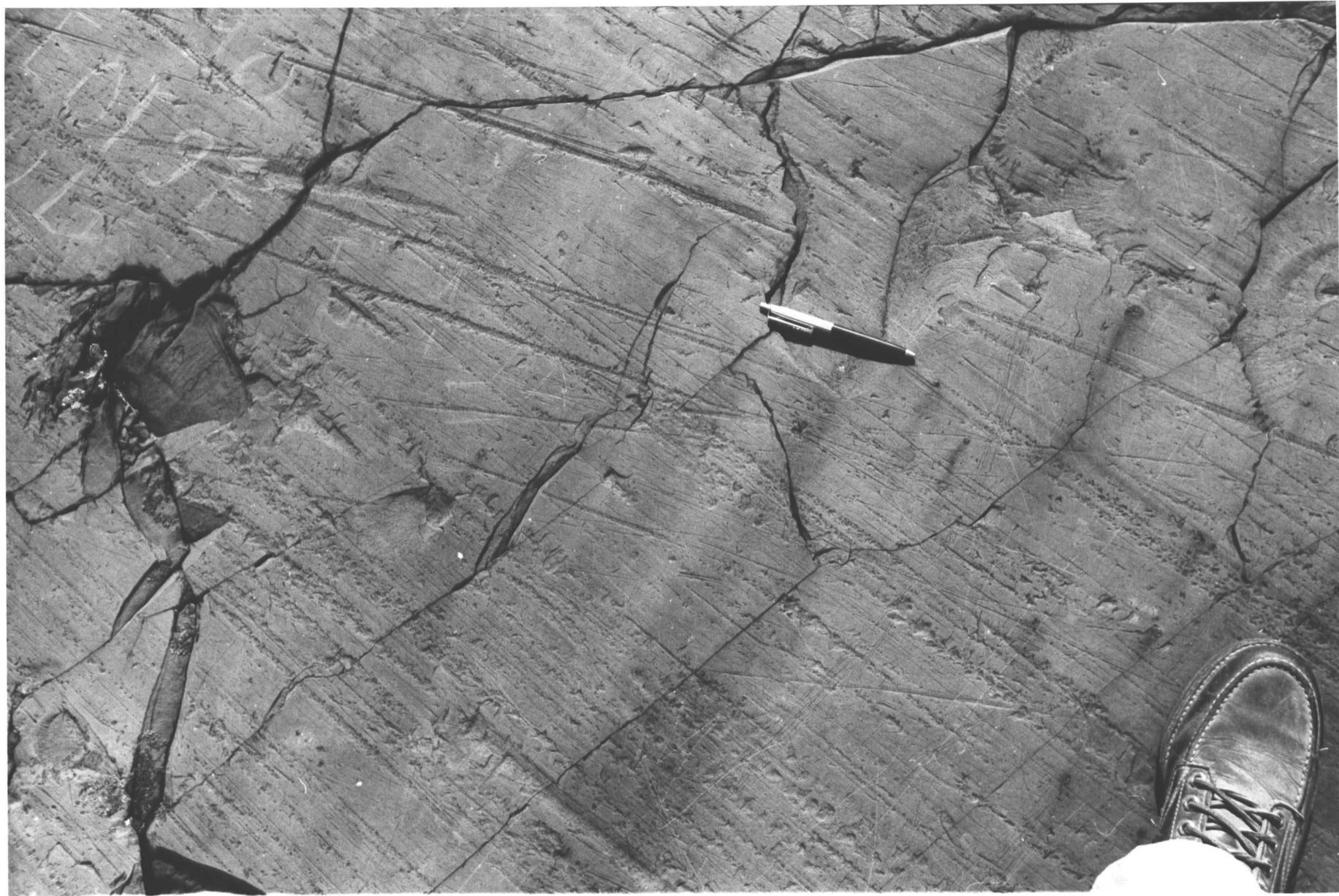
Lake deposits. The lowlands of the Whitehall quadrangle are covered with stratified lake sediments of clay, silty clay, silt, fine sand and sand, which in places is capped with pebbly sand. *This latter* <sup>was</sup> deposited in wave-washed environment of near shore or shoaling condition as the lake waned. It is evident that ~~a~~ least one ice-dammed lake occupied the lower part of the area after the ice had waned from the region. The surface of the lake deposits of the region now had <sup>s</sup> a fluvial dendritic topography made by the erosion of the lake sediments by the post-glacial streams. The surface slopes southward with the stream valleys from the clay deposits at 459 ft. altitude in the northeast corner of the quadrangle down to 160 ft. altitude in Poultney valley at Whitehall. The village of Fair Haven stands on a 1 x 2 mile plain of lake sand now standing a about 360 ft. ~~altitude~~.

altitude. This would appear to be the top of a deltaic mass of sediment built into the former lake by the ancient Castleton River, which has now cut a deep, steep-sided ravine through the deposit. This deposit is seen to continue northward along the Poultney River where the river has undercut the material to expose an 80-ft, bluff of laminated sand and varved, silt and clay. At the top of the bluff the flattish lake sediments display 5 or 6 good-sized undrained kettles 30 to 30 ft. deep. Gopher holes on the sides and bottoms of two or these kettles have thrown up coarse kame-like gravel. This condition can be explained only by having had ice blocks and kame gravels overlain by lake deposits so that when the buried ice blocks melted after the lake episode the kettles were formed by subsidence and never filled with any more gravel or lake sediments. Kame gravel is also overlain by lake sands at Gallup Point and Cold Spring between Sheldrick Hill and Champlain River in the central part of the quadrangle.









NW striae cross NE striae "Panning Rocks", mi west  
of Fair Haven Vt, Pen points N 10° W