Glacial Geology of Port Henry Quadrangle

Paul MacClintock 1966

Introduction

Location. This quadrangle lies in the Champlain lowland twenty miles south of Burlington. Lake Champlain spreads North - South through its middle part, so that the western half lies in New York State. The Vermont half is a low flat plain standing 50-100 feet above the lake except where Snake Mountain in its southeast corner rises a thousand feet above this plain. Most of the plain is covered with lake salt and clay into which small post-glacial streams have cut shallow valleys.

Bedrock

The bedrock of the quadrangle, sedimentary; limestone, shale, sandstone, and graywacke. The fossils which they contain shows that they accummulated in shallow marine waters connected to the ocean of the time. This body of water occupied the long narrow depression known technically as a geosyncline between the Green Mountain mass and the Adirondack mass. These same fossils also identify the rocks as belonging to the Cambrian Period

(550 million years ago) and the Ordovician Period (450 million years ago). They have long been studied by geologists and paleontologists. Fluctuations of this ancient sealevel has made it possible to subdivide them into many geological formations. The recent publication by Charles Welby (1961) lists and describes 25 such formations, each identified by its lithologic character as well as its fossil fauna.

These sedimentary rocks have subsequently been faulted and folded during one or more diastrophic episodes of the geologic history so that today they are seen in folds and broken into a complex array of fault blocks and thrust sheets. The land surface at this time must have been conspicuous and irregular so that to have reduced it to the gentle lowland of today required a long time of fluvial erosion which etched out the softer sedimentary rocks of the present lowlands and left standing as mountains the hard rocks of the present Green Mountains to the east and those of the Adirondacks to the west. The erosion of the soft rocks, however, has also etched out the slightly less

resistant ~~leads~~ beds and left standing in baserelief the slightly more resistant ones, to form long N. E. - S. W. ridges along the strike of the dipping layers. Not uncommonly these are questas where the dip-slope is to the east and the scarp slope is to the west. The term questaform plain has been applied to such a landscape. This lowland is now mantled with glacial drift and lake and/or marine sediments. This overburden varies in thickness from place to place from none, where the bedrock comes to the surface on the low hills, to 180 feet in the ice-~~covered~~ covered depression 2 miles S. W. of Vergennes and more than 300 feet in a similar depression 2 miles west of Ferrisburg. These thicknesses are reported in water well drillings and mapped by C. W. Welby (1961).

Glaciation

The glacially rounded ledges of limestone are not uncommonly well striated. Along the west shore of North Bay are seen long and deep striae bearing N 150°E, N 20°E, and N 30°E. The N 30°E. striae are the strongest and most persistant. On the northwest shore of Button Bay the Valcours limestone is heavily striated

with strike N.50°E. These show movement of the Shelbourne ice across the quadrangle. Till (1) On top of a broad hill 2 miles east of Ferrisburg an excavation exposed buff basal till with till fabric Vector Mean of N. 23°W., showing it to be Burlington till (2) Another exposure of till is seen in the west bluff of Otter Creek 1.5 miles west of Vergennes where 6-8 feet of dense basal till lies on shale bedrock. The till has N.W. fabric with maximum Mean 28°W. This is also Burlington till. (3) a gully just south of Potash Bay in blue-gray basal till shows fabric with the Vector mean of N. 18Ø°W. (4) Till in a gully 1 mile west of Palmer Corner at south edge of quadrangle is crudely stratified blue-gray sub-aqueous till which gives fabric with vector Mean of N. 14°W. and (5) 1/2 mile south of Addison a big road bank in buff silty basal till gives a fabric with Vector Mean of N. 28°W., showing it to be Burlington drift (6) Two and a quarter miles east of Addison a till bank gives a Vector Mean of N. 28°W. and a ledge of rock nearby has striae N. 30°W. (7) The big exposure of the Interstate Highway one mile east of Vergennes (in the Middlebury Quad) gives a Vector Mean of N.35°W.,

and (8) The Bank of a Creek 2 miles north of Ferrisburg exposes till with fabric ~~leaving~~ having Vector Mean of N.21°W. All the till of the quadrangle ~~lies~~ has northwest fabric maxima slowing it probably to correlate with the Burlington drift. (Stewart and MacClintock 1964) which in turn is considered to be of Mankato-Port Huron Age. The Potash Bay exposure in 25 ft. high above the stream level, and shows the upper 20 ft. of the till to be oxidized whereas, the lower 5 ft. is still the blue-gray of the unoxidized fresh till.

Lake Clay. As said before, the lowland of the quadrangle is covered with a mantle of clay which in many places is varved. Flattish lowlands of the area therefore are thought of as clay-filled pre-glacial strike valleys.

(1) The largest exposure of the varved clay is seen in the bluff along the north shore of Button Bay. This bluff is 25 feet high and after storm waves have washed it clean its lower part is seen to be made of buff colored sticky clay and silt varves. These varves are seen horizontal commonly, but in places tilted

and ~~are~~ folded by post-depositional sub-aqueous slumping. At ~~N~~northwestern end of the bluff horizontally bedded silty sand about 30 ft. thick makes up the bluff. This silty sand overlies and buries the varved sediments.

(2) Elm Point. The depression east of the rocky point is filled with clay which outcrops as a 15 ft. high bluff along the lake shore. It ~~is~~ oxidized to bluff color, and contains innumerable concretion both large and small; the largest one I found measured 8x15 inches. When broken open it showed concretionary growth throughout.

(3) Owls Head Bay. The shore here exposes 60 ft. of varved clay lying on glaciated bedrock striated N.30°E. The clay is very dense brown-buff winter layers 1/2 - 1 inch thick parted by summer layers a little thicker made of very fine silt and silty clay, visable where it dries on an exposed surface. The deposit must have been remote from a source of coarser clasties .

(4) At the D.A.R. State Park, one mile north of Chimney Point, the clay is estimated to be 100-150 ft. thick at the south edge of the Park, ~~at~~ the level of an upland flat.

(4) One mile south-southwest of Vergennes a roadside gravel pit exposes about 10 ft. of coarse and fine stratified gravel capped by 5 ft. of horizontally bedded fine clean sharp sandy gravel which is best interpreted as wave-washed beach material. This beach is in turn overlain by 10=15 ft. of varved lake silt and clay. This varved material is seen to drape over the small hill of kame gravel and down its flanks.

Ice-rafted Boulders.

Scattered widely over the lake plain are seen boulders; both large and small, and composed of many rock types. The farmers for years have been dragging them off their fields and stocking them along fence-rows or on outcropping ledges of bed rock, or dumping them into gullies and ravines. Exposures of the clay also show them down in the clay where they are seen to bend down the clay layers under them whereas the upper clay layers are seen to drape over them. This evidence shows that the boulders were deposited contemporaneously with the varved clay. This confirms the idea of an ice-dammed lake with the edge of the glacier making the ~~water~~ northern edge of the lake and that boulder-bearing icebergs broke into the lake and floated

southward where the boulders were dropped as they melted out of the bergs. The boulder - bearing clays were therefore deposited after the ice had moved to the north of the area.

Lake Beaches. On the west slope of Snake Mountain, 1/2 mile ~~east~~ west of Willmarth School is a horizontal beach ridge of sand and gravel. It is about 10 ft. high and 50 to 75 ft. wide. Its altitude is 500 ft. This altitude is the same as the beach ridges a mile southwest of Port ~~Hurey~~ Ivory, New York. Since these latter, Chapman (1937), specifies as the beaches of the Coveville stage of Lake Vermont, it is concluded that this beach on Snake Mountain is also the Coveville shore line. On the north slope of Snake Mountain, 1 1/2 miles east of Addison a second beach deposit of sand and gravel occurs at 366 ft. altitude. This would correlate with Chapmans Fort Ann stage of Lake Vermont.

Champlain Sea. At several places within the quadrangle the surficial deposits contain Marine fossils. (1) One mile south of the mouth of Otter Creek, near the northern edge of the quadrangle, fossil shells are found in beach sandy gravel. This deposit is on top of the hill and at 230 feet altitude. The

shells are mostly of Macoma. (2) 1 1/2 miles south of mouth of Otter Creek in the lowland at 110 ft. altitude a roadside barrow pit exposes clay containing Macoma fossils. (3) Three miles north of the quadrangle on the east slope of Barber Hill, altitude 270 ft. is sandy pebbly beach deposit rich in shells. They can be picked up by the handful (4) At Button Bay the north shore exposes clay containing Macoma and saxacava (Hiatella) fossils. At the top of the clay is 4-5 ft. of sand likewise containing Macoma shells. These deposits show that an invasion of marine water flooded the area and its deposits overlay the lake sediments. Erosion has, in many places stripped off this marine material to leave the lake clays and boulders now exposed at the surface. It has been long thought that the boulders were the result of icebergs floating on the sea water, but more recent work has shown that the nearest place where ~~action~~ va glacial ice projected into marine water was in St. Narcisse region, Quebec, north of Three Rivers, which would require quite a long journey for boulders and also this would not have embedded the boulders down in the varved clay.

The shoreline of this ancient sea is found in the sea-cliff along the northwest slope of the ridge which extends southwest from Vergennes five miles to Addison. This ridge is composed in its northern part, of bedrock capped with 20-30 feet of lake sediments. In its southern part the bedrock is capped by a blanket of till, a score or so of feet in thickness. Along the northern slope of this hill is seen a steepish scarp cut into the till blanket at the south. The scarp is now dissected by many small gullies the large of which have allevial fans at the base, whereas the smaller ones lack such fans and show instead a horizontal deposit of pebbly beach sand and gravel composed of horizontal bedded material. This shows that these latter gullies were eroded while waves and currents were transporting away from the lower end of the gully the sediment carried downward by gully streamlets. These fan-less gullies, therefore, show rather precisely the level of the waves of the Champlain Sea. A hand-level traverse from the ancient sealevel up to a benchmark at the edge of highway route 22A gives its present altitude to be 247 feet. A mile south of East Panton the sea-cliff is cut into till

to make bluff 40 feet high. Now dissected by gullies which end, again, at their lower ends in a horizontal deposit of beach gravel. The altitude of top of the beach as taken off the topographic map is between 230 and 240 feet. The levels fits with the numerous other measurements along the tilted beaches of the Champlain Sea (Chapman 1937).