SURFICIAL MAPPING AND GLACIAL HISTORY OF NOTCH BROOK VALLEY, NORTH ADAMS, MASSACHUSETTS

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PURPOSE

The purpose of this study is to map surficial glacial and post-glacial deposits in Notch Brook Valley. Through studying this map and other methods of analysis we can then determine a chronology of deglaciation and post-glacial events.

METHODS

As this area has never before been studied, most work was done directly in the field. Detailed mapping was performed using pace, compass, and altimeter readings. Pits were dug as well as excavating stream cuts to look at surficial material, grain size, color, bedding and laminations, imbrication, and other features. Stereopair photos and topographic maps were used to detect large-scale glacial features and contacts.

Finally, x-ray diffraction scans were performed on clays to determine their possible origin. Two samples of laminated clay were taken from a hillslope at The Cascade for x-ray diffraction analysis. These samples were mixed with water, dissaggregated, then separated into >1 and <1 micron fractions using a centrifuge. The clay/water mixtures were next shaken and allowed to dry on glass slides in order to produce oriented mounts. X-ray diffraction analysis was performed on a Scintag/USA DMS 2000 Diffractometer using CuKα radiation. In order to identify the clay minerals, the samples were saturated with ethylene glycol, heated to 350 degrees Celsius for one hour, and heated to 500 degrees for one hour between diffraction scans.

GEOLOGIC SETTING

Notch Brook Valley is bounded by the Ragged Mountains to the east and the Greylock Range to the west. Notch Brook and many small tributaries drain the Notch Brook Valley; the brook in turn empties north into the Hoosic River. The source of Notch Brook is at the Bellows Pipe, a saddle connecting the Greylock and Ragged mountains. Notch Valley is a bedrock controlled structural valley oriented nearly north-south with a knickpoint at The Cascade, a small waterfall. Bedrock in the area is entirely composed of phyllite. Notch Reservoir, located at about 1240 feet, is a manmade feature. Mt. Williams Reservoir is also included in the study area; unlike the Notch Reservoir, Mt. Williams Reservoir may be a natural feature, although it is currently controlled by a man-made dam. Lush, dense vegetation, including both coniferous and deciduous forest, covers most of the area.

During the latest Wisconsinian glaciation, the Hudson-Champlaign lobe of the Laurentide ice sheet advanced southeastward over this region as far as Cape Cod, MA, and Long Island, NY. As the glacier retreated, Mt. Greylock and other highlands were first exposed; the area was ice-free by about 15,000 years ago. Since the Hoosic River drained north directly into the retreating ice sheet, water ponded and formed Glacial Lake Bascom. Two levels of this ancient glacial lake effected the 3.5 mile long Notch Brook Valley. The highest level of Lake Bascom was probably at about 1040 feet This 1040 foot level of the lake is the most crucial to Notch Valley as the 1040 foot contour runs along the edge of Mt. Williams Reservoir and into Notch Valley up to The Cascades. A 900 foot level of Lake Bascom also affected the Notch Brook Valley.

RESULTS

As the primary objective of this study was to map glacial and post-glacial features in Notch Brook Valley, the resultant maps are shown in Figures 1 and 2. Features of particulat interest in the mapping area include:

Till - Two types of till are seen in the valley: parent and soily. Parent till is common to the site area, consisting of unsorted pebbles surrounded by a fine clay matrix deposited directly beneath the glacier. Soily till dominates the landscape and is composed of weathered, reworked, or bioturbated parent material lacking clay-sized particles. Many of the cuts reveal that this type of till is highly oxidized.

Erratics- Angular, sub-angular, and sub-rounded with chatter marks, erratics are predominantly Cheshire Quartzite. Others are phyllite, the local bedrock. The size of erratics ranges from pebbles and gravel up to massive boulders, the largest measuring 7.7 ft high (2.3 m), 9.7 ft wide (2.93 m), and 9.5 ft long (2.87 m). The majority of boulders found are located north of The Cascades. South of The Cascades boulders decrease in size and number. Many of the erratics are imbricated; boulders as large as 6.6 ft (2 m) by 6.6 ft (2m) by 3.3 ft (1 m) are shingled against each other.

Boulder bars - Located north of The Cascades, these elongated formations of imbricated boulders rest on parent till. Of the three bars identified, the largest is 19.6 m (65 ft) wide and 96.9 m (320 ft) long.

Kame deposit - Found at The Bellows Pipe, the kame deposit is very fine, well-sorted sand with no signs of layering, indicating that it is of ice contact origin and not lake sand. Aeolian silt--wind-blown material-- is also in The Bellows Pipe region.

Lake sands - A large deposit of sand was discovered north and downslope of Mt. Williams Reservoir. A pit dug at a 40 foot escarpment near an active stream channel revealed a contact between overlaying laminated clays and fine sands with occasional lenses of clay and gravel. This indicates that these deposits were of lacusturine origin.

Lake clays and clay mineral analyses - Three deposits of clays discovered in Notch Brook Valley show definite, although severely disturbed, laminations. The first x-ray diffraction scans performed on the <1 micron clay fraction from The Cascade indicated minerals having peaks at 14A, 10A, 7A, 5A, 3.6A, 3.5A, 3.3A, and two peaks at about 3.2A representing plagioclase and alkali feldspar. As the 14A, 7A, and 3.5A peaks could correspond to either vermiculite and smectite or chlorite, ethylene glycol saturation was necessary to differentiate between expandable (vermiculite and smectite) and non-expandable (chlorite) sheet silicates. Upon saturation, the 14A peak expanded; it and the 7A peak partially collapsed upon heating to 350 degrees Celsius. This indicated the presence of all three minerals. Upon heating to 500 degrees, the 7A and 3.5A peaks collapsed still, further indicating that the clay must also contain kaolinite. The 10A, 5A, and 3.3A peaks remained unaffected by the various treatments; they correspond to the mineral illite. In addition to the afore mentioned clay minerals and feldspars, the >1 micron fraction also contained a quartz peak. The results of these scans will be compared with other scans of Lake Bascom clays to determine a possible correlation.

DISCUSSION

From the study of these features a simple chronological history can be created. As the glacier advanced massive amounts of till were laid down filling the entire valley. Mt. Williams Reservoir may have been formed at this time by the deposition of a lateral moraine at the base of Mt.Willams. This feature, possibly of natural origin, is now controlled by a man-made dam. As the Hudson-Champlaign lobe retreated, water draining north was trapped against the edge of the glacier and ponded, forming Glacial Lake Bascom. This calm lacustrine environment allowed for the deposition and lamination of fine clays and sands. As the ice front retreated, lakebed sediments dried out and became windborne, eventually settling to become aeolian silt deposits. Lake clays and sands found in the western portion of our mapping area form an abrupt contact with the surrounding areas. The marked difference in terrain is further proof that these deposits are of lacustrine origin. Either during or after the time of Glacial Lake Bascom, debris flows let down material, providing the foundation for fluvial processes to imbricate boulders and cobbles. The boulder bars studied are lenticular, decreasing in width as distance from the boulder increases. We theorize that these erratics, too large for the modern stream to transport, were let down from lag deposits. Due to erosion and gravity, boulders surrounded by a matrix of till have loosed themselves and fallen down slope. This large boulder in the stream diverts and slows water flow, causing sediments to drop out and accumulate. This idea is consistent with observations made of the largest bar, 19.6 m (65 ft) wide and 96.9 m (320 ft) long, which is partly underlain by till. Finally, terraces and erosional scarps were formed as the stram down cut to its current floodplain.

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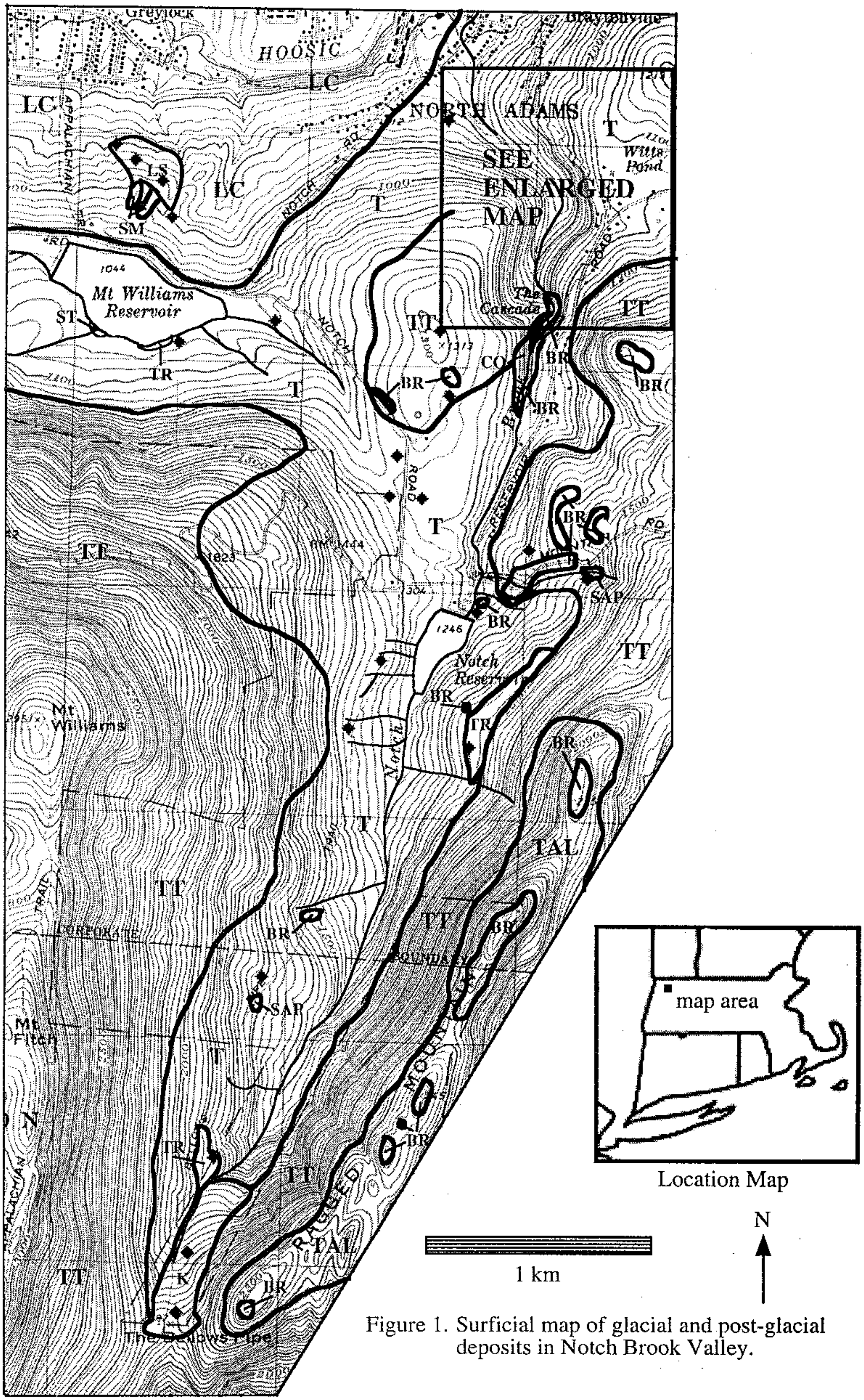
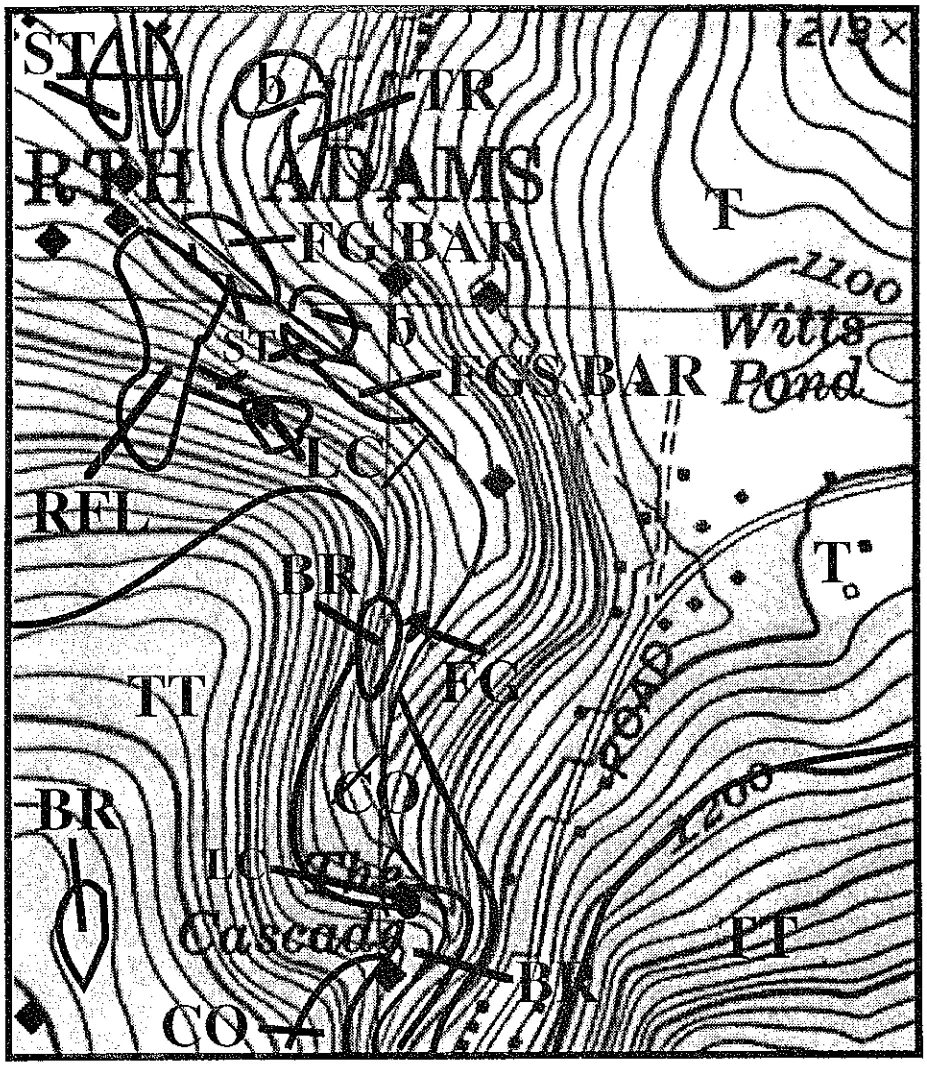


Figure 1. Surficial map of glacial and post-glacial deposits in Notch Brook Valley.

Figure 2. Enlarged map of area south of The Cascade showing boulder bars and lake clays.



0.5 km

KEY TO MAPS

BR - **bedrock** (phyllite)
SAP - **saprolite**; chemically weathered bedrock
TAL - **talus**; angular rock fragments derived form parent source
T - **thick till**; >3 m or 10 ft; ustratified material deposited subglacially, consists of a clay matrix with various clasts
TT - **thin till**; <3 m or 10 ft
LS - **lake sands**; sand sized particles deposited in a lake
LC - **lake clays**; clay sized particles and minerals of lacustrine origin
K - **undifferentiated kame deposit**; ice-contact deposit, generally hummocky terrain, composed of fine sand
FG - **fluvially deposited** boulders, gravel, sand, or silt; may be in bars
ST -**stream-cut terrace**; flat or gently sloping surface, erosional remnant of modern stream
TR - **till terrace**; flat or gently sloping surface composed of till, thought to to erosional remnant of previous till surface
CO - **colluvium**; loose material of various sizes creeping downslope
SM - **slide material and debris**; fallen material creating feature of escarpment on hillslope and lobe beneath
RFL - **rock fall**; fallen boulders creating escarpment and lobe
b - **boulder patch**; isolated cluster of boulders with little matrix

◆ - **pit** or **cut**

⁀ **spring** or **stream**