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Androscoggin County, Maine*

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Surficial Geology of the Lake Auburn East 7.5-Minute Quadrangle, Androscoggin County, Maine

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INTRODUCTION

This report describes the surficial geology and Quaternary history of the Lake Auburn East quadrangle in southwestern Maine. Surficial earth materials include unconsolidated sediments (sand, gravel, etc.) of glacial and nonglacial origin. Most of these deposits formed during and after the latest episode of glaciation in Maine, called the Wisconsinan glaciation, starting about 25,000 years ago.

Surficial sediments cover the bedrock over most of the quadrangle and are subject to many uses and environmental considerations. These include sand and gravel extraction, development and protection of groundwater supplies, siting of waste disposal facilities, and agriculture (Thompson, 2001).

The field work for this study was carried out in 2001 for the STATEMAP cooperative between the Maine Geological Survey and the U.S. Geological Survey (USGS). Two maps are associated with this report. The *geologic map* (Hildreth, 2002a) shows the distribution of sedimentary units and indicates their age, composition, and known or inferred origin. It also includes information on the geologic history of the quadrangle, such as features indicating the flow direction of glacial ice. This map provides the basis for the following discussion of glacial and postglacial history.

The *materials map* (Locke and Hildreth, 2002) shows specific data used to help construct the geologic map. These data include observations from gravel pits, shovel and auger holes, construction sites, and natural exposures along stream banks. The materials map also shows boring and well logs. Sand and gravel aquifer studies by the USGS provided additional data on the type and thickness of surficial sediments in the quadrangle (Prescott, 1967, 1968).

Geographic Setting

The Lake Auburn East 7.5-minute quadrangle has an area of about 133 km² (52 mi²). It is located in southwestern Maine,

near the approximate border between the White Mountain foothills (a.k.a. Oxford Hills) and the Seaboard Lowland physiographic province, about 55 km (35 mi) north of Portland. It includes parts of the towns of Turner, Leeds, and Greene, and the cities of Auburn and Lewiston. Altitudes range from 49 m (164 ft), which is the level of the Androscoggin River where it flows south at the south edge of the quadrangle, to over 217 m (735 ft) at the crest of a south-southwest-trending ridge in the northeast part of the quadrangle, just west of Deane Pond. The southern part of Lake Auburn in the adjoining quadrangle has a deep basin where water depths reach 120 feet (37 m) (Northrop, 1995).

Many ridges in the Lake Auburn East quadrangle were shaped by glacial ice flowing south-southeast and have been elongated in that direction. The topography in the study area is also controlled by folding in the Silurian metasedimentary rocks. The major stream drainage in the quadrangle is the south-flowing Androscoggin River that roughly bisects the quadrangle, and which has two moderate-sized tributaries in the quadrangle: Lake Auburn, whose outlet stream leaves the lake at its east end and flows south to join the Androscoggin just south of the quadrangle; and Stetson Stream (including Berry Pond), which drains much of the southeast part of the quadrangle, entering the Androscoggin at Lewiston near the south end of the quadrangle. The headwaters of No Name Pond drain the southeasternmost part of the area, and thence flow south and finally east to join the Sabattus River which meets the Androscoggin near the south edge of the Lisbon Falls North quadrangle. Hooper Brook drains the northeasternmost part of the quadrangle south-southeastward into Sabbatus Pond. Meadow Brook drains the northwesternmost part of the quadrangle northward to the Nezinscot River, which flows east-northeastward just north of the quadrangle and joins the Androscoggin at Keene Mills in the Turner Center quadrangle. Allen Pond drains the northeast part of the quadrangle northward to the Androscoggin near Keene Mills.

Esker deposits (unit Pge)

An esker deposit extends southeastward from the west edge of the map, into marine delta deposits (Pmdita) underlying Twitchell Airport. This segmented ridge of sand and gravel was deposited by meltwater streams flowing southeast in a tunnel in the bottom of the last ice sheet. In places it is bordered by depressions (kettles) left when masses of glacial ice melted. It is the southeasternmost extension of a long esker system in the Lake Auburn West quadrangle (Thompson, 2001). The ridge is part of a branching esker system that can be traced from near Black Mountain discontinuously south to this area. "Whether meltwater flowed simultaneously through this entire tunnel network is debatable, but it is likely that the esker segments formed progressively from south to north as the tunnel became clogged with sediment during deglaciation" (Thompson, 2000).

Some exposed segments of the esker are more than 50 ft (15 m) high, but in many places it is more or less buried by adjacent younger outwash deposits. Most subsurface data indicate a maximum depth of less than 70 ft (21 m). Pits contain mostly sand to pebble-cobble gravel, with occasional boulders. The esker is useful as a source of sand and gravel and as a municipal aquifer (Prescott, 1968).

Glaciomarine ice-contact delta deposits (unit Pmdi)

These deposits consist of ice-contact sand, gravel, silt, and mud that built into the late-glacial sea. They indicate stillstand positions of the ice margin as it retreated northward through the area. The positions are based on topographic expression, including collapsed kettle topography, ice-contact slopes, and topset-foreset bedding where exposed in borrow pits. The deltaic sediments are graded southward or southeastward in each deposit. Several deltas are given unique names: the oldest, Grace-lawn delta (Pmdigl), has a topset-foreset contact measured at 342 feet elevation (Thompson and others, 1989). Other named deltas in inferred order of deposition are Saint Peter Cemetery-Merrill Road delta (Pmdispm), Auburn Plains delta (Pmdiap), and Twitchell Airport delta (Pmdita). Parts of these marine deltas have been eroded by streams during offlap of the sea.

Much of unit Pmdi in the Lake Auburn East area is underlain by silt and clay of probable glaciomarine origin (Presumpscot Formation, unit Pp). For the most part, the underlying silt and clay is not exposed except in stream valleys that have cut down through the overlying sands or in man-made excavations. The thickness of these deposits may be as great as 21 meters (70 feet).

In places, unit Pmdi is overlain by dune deposits (Qe), some of which are thin and unmapped.

Undifferentiated glaciomarine sediments (unit Pm)

Unit Pm consists of waterlaid sediments that range from clay to gravel. These materials were probably deposited on the

late-glacial sea floor, but they are poorly exposed and may include sediments formed in other environments (Thompson, 2001). They have been dissected by modern streams, and their surface materials probably were reworked during the regression of the sea.

Glaciofluvial and glaciomarine deposits of Hooper Brook valley (unit Phb)

Relatively thin deposits (less than 20 feet [6 m] thick) of sand, silt, and gravel within the Hooper Brook valley are near the marine limit at the north end, where the deposits are more fluvial in nature. They are generally finer grained southward along the valley, culminating in marine muds of the Presumpscot Formation (Pp). Phb sediments are incised by the rather broad swampy alluvial channel of late-glacial Hooper Brook, which is interpreted herein to have followed a southwesterly course north of Route 202 at Greene village center, crossing Route 202 in a swampy channel just east of the Greene Central School grounds, and flowing southwest via a boulder-strewn channel into the headwaters of Stetson Stream. The channel was probably followed by voluminous meltwaters during the beginning stages of sea level regression, during isostatic rebound of the area. Isostatic rebound (upward to the northwest) probably aided in diverting the course of Hooper Brook (a mere trickle today compared to its late-glacial volume) to its modern channel which flows southeast to Sabbatus Pond in the Monmouth quadrangle.

Glaciomarine bottom deposits (Presumpscot Formation) (unit Pp)

Muddy sediments consisting predominantly of silt and clay with local sandy beds and intercalations are interpreted here as late-glacial sea-floor deposits of the Presumpscot Formation (Bloom, 1960). These deposits were derived from glacial meltwaters and laid down at the bottom of the late-glacial sea following the retreat of the ice sheet and prior to uplift of the area above the sea. The silt and clay commonly lies beneath units Ha, Hw, Hls, Pm, Phb, Pmdi, and Pmrs. It is as much as 150 ft (50 m) thick. In places, Pp is overlain by relatively thick dune deposits (Qe) and thin unmapped dune deposits.

Marine regressive deposits (unit Pmrs)

Relatively thin deposits of sand, silt, and minor gravel are interpreted to be reworked marine delta and fan deposits, outwash materials, and sea-floor deposits redistributed by marine currents and wave action as sea level fell during late-glacial time, long after the glacier left the immediate area. After deposition of the Presumpscot Formation (unit Pp), existing units were reworked and regressive sandy deposits were laid down (Pmrs). Generally, these are thin and are not more than 10 ft (3 m) thick. They overlie parts of units Pmdi, Pm, and Pp; and, in places,

Pmrs is overlain by relatively thick dune deposits (Qe) or thin unmapped dune deposits.

Eolian deposits (unit Qe)

When sea level fell and exposed the sandy glaciomarine sediments and regressive marine deposits, wind erosion was extensive before vegetation was able to take root and anchor the sediments. As a result, generally thin deposits of windblown sand formed. Only the larger Qe deposits are mapped here. Thin dune deposits are far more extensive than the area mapped as Qe in the Lake Auburn East area, because they are patchy and not easily recognized except in excavations, which are sparse. Detailed mapping of all these dune deposits in the area may help decipher the complex history of their formation.

Stream terrace (unit Qst)

In cutting down their channels to their present levels, the late-glacial and modern Androscoggin River and its tributaries cut into glacial deposits and built or carved stream terraces along their paths, parts of which are preserved as elevated terraces along margins of the modern flood plains. Some of the Qst area may be inundated during major floods, but most appears to be high enough to miss being flooded during ordinary flooding. Where the terrace is underlain by alluvial material, it may contain as much as 15 ft (5 m) of sand and gravel.

Holocene lakeshore deposits (Hls)

Modern beach and nearshore deposits (Hls) have formed along scattered stretches of the Lake Auburn shoreline, especially as pocket beaches and as baymouth bars. Deposits are generally less than 6 ft (2 m) thick.

Wetland deposits (unit Hw)

Freshwater swamp deposits characterized by accumulations of fine-grained organic-rich sediments, deposited in low, flat, poorly drained areas are scattered throughout the quadrangle. Little information is available on the thickness of these deposits in the Lake Auburn East area, though Cameron and others (1984) report that peat deposits in southwestern Maine generally average less than 20 ft (6 m) in thickness. In places the unit is indistinguishable from, grades into, or is interbedded with alluvium (Ha). It should be noted that both swamp (Hw) and alluvial deposits (Ha) are coincident along many stretches of flood plains in this area.

Stream alluvium (unit Ha)

Sand, gravel, silt, and organic materials have been deposited by modern streams on their flood plains. The extent of alluvium indicates areas that flooded in the past and may be subject

to flooding in the future. In places the unit is indistinguishable from, grades into, or is interbedded with wetland deposits (Hw). Both swamp (Hw) and alluvial deposits (Ha) are coincident along many stretches of flood plains in this area.

Artificial fill (unit af)

Areas where the original ground surface is covered by a substantial thickness of imported material, both man-made and natural, are mapped as artificial fill (unit af). The material varies from natural sand and gravel to quarry waste to sanitary landfill. The thickness varies, but usually doesn't exceed 20 ft (6 m).

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