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Title: *Surficial Geology of the Milton 7.5-minute Quadrangle, York County, Maine*

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Surficial Geology of the Milton 7.5-minute Quadrangle, York County, Maine

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INTRODUCTION

Surficial geologic mapping was conducted in the Milton 7.5-minute quadrangle in southern Maine during the summer of 1989 as part of the mapping program of the Maine Geological Survey. Two 1:24,000 maps were prepared: (1) a materials map (Meglioli, 1998) that shows thicknesses and textural characteristics of surficial earth materials at selected locations, and (2) a geologic map (Meglioli, 1999) that shows the distribution of sedimentary units.

The Milton quadrangle extends in latitude from 43°22'30" N to 43°30'00" N, and in longitude from 70°52'30" W to 71°00'00" W. It covers an area of about 55 mi^2 (142 km^2), of which approximately 25% (the westernmost portion) lies within New Hampshire. The study area is located about 5-6 miles west of the city of Sanford. The western boundary runs from north to south along the Salmon Falls River, which follows the New Hampshire-Maine border.

Elevations in the study area range from about 300 feet at the southeast corner of the quadrangle to about 900 feet above sea level in the northern part. Most of the land surface within the quadrangle is characterized by hilly topography, with locally steep slopes, mainly in the central and northern portions of the area. In contrast, the southeast corner of the quadrangle has areas which are flat to gently sloping with a topographic gradient that decreases gradually to the southeast.

There are several drumlinoid hills in the quadrangle. They have been elongated parallel to the flow of glacial ice, and their long axes are predominantly oriented in a northwest-southeast direction. These hills are bedrock knobs commonly covered with a thin veneer of till and some colluviated material. They are usually separated by lowlands, which in some cases are occupied by swamps.

The southward-flowing Salmon Falls River is the major drainage system of this area. It receives the discharge of many small, rather sluggish tributaries. There is also a series of creeks oriented NW-SE, parallel to the long axes of the hills.

BEDROCK GEOLOGY

Stratigraphy

The bedrock units of this area have been mapped by Hussey (1985). The Milton quadrangle is mainly underlain by a variety of metamorphic rocks of the Shapleigh Group and to a lesser extent by granitic and granodioritic intrusive rocks.

The Shapleigh Group includes, in ascending stratigraphic order, the Lower and Upper members of the Rindgemere Formation, the Towow Formation, and an unnamed unit above the Towow Formation. It also includes a unit interpreted by Hussey (1985) to be a separate unit, still unnamed, stratigraphically placed between the Upper and Lower members of the Rindgemere Formation.

Rindgemere Formation - Lower Member: Typically a sequence of variably bedded metamorphosed pelitic shale and argillaceous sandstone, with minor rusty-weathering pelitic and non-rusty calcareous sediments.

Upper Member: Consists of rhythmically bedded, generally thin to medium bedded and occasionally massive metamorphosed pelite, argillaceous sandstone, and granule-bearing argillaceous sandstone metamorphosed to andalusite-staurolite and sillimanite-staurolite grades.

Towow Formation - This formation is a sequence of rusty-weathering pyrrhotitic muscovite-quartz schists and dark-gray graphitic muscovitic phyllite.

Unnamed Unit Above the Towow Formation - Consists of a non-rusty rhythmically bedded metasandstone with thin metapelitic tops of graded beds.

The Lower Member of the Rindgmere Formation is probably of Silurian age, and the Upper Rindgmere, Towow, and unnamed unit above the Towow Formation are probably of Early Devonian age (Hussey, 1985).

In the study area, a few small unnamed felsic plutons of granitic and granodioritic rocks crop out as well. They are considered to be Early Devonian age by Hussey (1985). They usu-

ally consist of two-mica granite and to a lesser extent of granodiorite.

Structure

The rocks interpreted as being part of the Shapleigh Group have been affected by two major fold deformations; the earlier being recumbent and the later being upright to slightly overturned. In addition, they have been affected by several minor events including the development of slip cleavage, crenulations, and kink bands.

GLACIAL AND POSTGLACIAL DEPOSITS

Not many good exposures of surficial sediments were found within the Milton quadrangle. Therefore, field work was mainly limited to observation and description of the few active and inactive gravel pits within the quadrangle.

Stratigraphic relationships, as well as the distribution of surficial deposits in the study area, seem to be largely the result of the activity of the Late Wisconsinan ice sheet. Few deposits show evidence of postglacial erosion. The surficial sediments were subdivided into: (a) Deposits composed of material deposited directly from ice (till); (b) water-laid glacial deposits (e.g. outwash gravels), and (c) minor deposits of nonglacial origin (e.g. alluvium along streams).

Description of Map Units

Till - Till (map unit Pt) is a loose to moderately compact, sandy-silty, diamicton that was deposited from glacial ice. It consists of a nonsorted, nonstratified mixture of silt, sand, pebbles, cobbles, and boulders. Occasionally the matrix contains minor amounts of oxidized clay.

Till covers much of the quadrangle. The predominant orientation of glacially streamlined bedrock knobs suggests that the till was derived from the northwest. To a large extent the northern part of the Milton quadrangle is mantled with a very thin veneer of till, commonly less than 10 feet (3m) thick, as indicated by the ruled pattern on the geologic map.

Recognition and mapping of till deposits in the field was primarily based on morphologic characteristics, as well as the presence of boulders and analysis of sedimentological characteristics seen in gravel pits and road cuts. The morphology and sedimentary textures of the unit suggest that most till exposed at the ground surface in the Milton quadrangle can be classified as an ablation till deposited during the retreat of the ice sheet.

Lodgement till was seen in only two small outcrops in the southwestern corner of the map area, where it underlies glaciofluvial gravels deposited during ice recession. However, this compact, fine-grained till probably forms a significant portion of the smooth, glacially streamlined hills in the quadrangle.

End Moraines - In the west-central part of the study area, several small ridges have been mapped, on the basis of morphology and internal structure, as end moraines (unit Pem). One of them was being excavated and was well exposed at the time of field work. These ridges are composed mainly of till and were built at the margin of the last (late Wisconsinan) glacial ice sheet during its recession.

Deposits Formed by Glacial Meltwater - Water-laid glacial deposits in the quadrangle are interpreted as having formed during the retreat of the late Wisconsinan ice sheet. They are chiefly concentrated in the southern part of the quadrangle. Portions of this gravelly area have been mapped as outwash deposits (unit Pgo) based on their texture and topography. Much of the outwash in the eastern and southeastern part of the quadrangle is probably just a thin, discontinous veneer over glacial till. The outwash along the Salmon Falls River (southwest corner of study area) is generally at the same elevation as the inferred limit of late-glacial marine submergence in this part of Maine, and thus may actually be a glaciomarine delta.

Three eskers (unit Pge) have been mapped in the quadrangle. These ridges of sand and gravel were deposited in glacial tunnels by meltwater streams flowing in a generally southward direction. Two short esker ridges protrude from Milton Pond on the east side of the Salmon Falls River valley. Another esker likewise extends southeast from the Salmon Falls valley in the central part of the quadrangle.

Deltaic deposits (unit Pld) occur along the western margin of the study area, in the Salmon Falls River valley. They are composed primarily of medium to coarse sand and gravel. The tops of these deltas have elevations of over 400 ft, and are too high for the deposits to be marine. The deltas were deposited in a glacial lake that probably was impounded by a temporary dam composed of glacial sediments, located at the constriction in the valley at Milton village. The small ice-contact delta(?) south of Milton Pond may represent an early high-level stage of this lake, while the deltas farther north — including the more extensive deposits on the New Hampshire side of the state line — were graded to a much larger water body at about 430-440 ft.

Some of the glacial sand and gravel deposits are included in unit Pgi. These deposits are believed to have formed in contact with decaying ice, but the details of their depositional environment are unclear.

Postglacial Deposits - Deposits of postglacial (Holocene) age include colluvium (unit Hc); lakeshore deposits (unit Hls); stream alluvium (unit Ha); stream terraces (unit Hst); and wetlands (units Hws and Hw). Colluvium is poorly-sorted rubble on hillsides, formed by frost action and downslope movement acting on surficial sediments and/or bedrock. In many cases, it is not mapped because it is just a veneer on the underlying surficial deposits. A small area of colluvium is shown on the geologic map, adjacent to Northeast Pond on the western edge of the study area. Lakeshore deposits have developed along the shorelines of modern lakes in the Salmon Falls River valley, where they com-

prise sandy beaches. These deposits formed by erosion of adjacent glacial sediments which are subjected to wave attack.

Stream alluvium occurs on the flood plains of brooks and rivers, where it is deposited during periods of high water. It often consists of fine-grained silt and sand, but may include gravel along higher-energy streams. Some flood plains have been abandoned as their parent streams cut downward, and are seldom, if ever, inundated by modern floods. The latter areas are mapped as stream terraces.

Wetlands have developed in poorly drained areas. The recent sediments that have accumulated in wetlands are typically fine-grained and may include considerable organic material. Some of the wetlands with a tree cover are mapped as swamps (Hws). Many of the wetlands on the geologic map were delineated on a reconnaissance basis, using aerial photographs, so the boundaries shown here should be considered approximate.

Glacial History

Although it is almost certain that several glaciations have affected southern Maine, no evidence of definite pre-late Wisconsinan glacial deposits was found in the Milton quadrangle. Two or three small exposures of lodgement till were found beneath ablation till, but are not conclusive evidence of an earlier glaciation. Erosion and deposition by the late Wisconsinan Laurentide ice sheet probably removed or covered the deposits of previous glaciations. Therefore, it is concluded that most or all of the glacial deposits mapped within the study area are the product of the last glacial event in late Wisconsinan time. Several regional studies have shown that the Laurentide ice sheet completely covered the Gulf of Maine during the last glacial maximum (Thompson and Borns, 1985 a,b; Smith, 1982, 1985). Regionally, the direction of ice flow was from the northwest to the southeast as suggested by the directions of striations, the alignment of glacially streamlined hills, and the trend of the small arcuate moraines.

Glacial retreat probably began on the continental shelf off New England approximately 17,000 yr B.P., and the ice margin may have been near the coast in southwestern Maine at approximately 14,000 yr B.P. (Thompson, 1982). The topography of the bedrock played an important role in the distribution of the glacial deposits in New England (Koteff and Pessl, 1981). Unfortunately, the lack of continuity of moraine ridges and the scarcity of other geomorphic indicators prevent an accurate reconstruction of the recessional ice margin positions in the Milton quadrangle.

REFERENCES CITED

Hussey, A.M., II, 1985, The bedrock geology of the Bath and Portland 2-degree map sheet, Maine: Maine Geological Survey, Open-File Report 85-87, 82 p.

Koteff, C. and Pessl, F., Jr., 1981, Systematic ice retreat in New England: U.S. Geological Survey, Professional Paper 1179, 20 p.

Meglioli, A., 1998, Surficial materials of the Milton quadrangle, Maine: Maine Geological Survey, Open-File Map 98-173.

Meglioli, A., 1999, Surficial geology of the Milton quadrangle, Maine: Maine Geological Survey, Open-File Map 99-91.

Smith, G. W., 1982, End moraines and the pattern of the last ice retreat from central and southern Maine, *in* Larson, G. J. and Stone, B. D. (eds.), Late Wisconsinan glaciation of New England: Kendall Hunt, Dubuque, Iowa, p. 195-210.

Smith, G. W., 1985, Chronology of Late Wisconsinan deglaciation of coastal Maine, *in* Borns, H. W., Jr., Lasalle, P., and Thompson, W. B. (eds.), Late Pleistocene history of northeastern New England and adjacent Quebec: Geological Society of America, Special Paper 197, p. 29-44.

Thompson, W. B., 1982, Recession of the late Wisconsinan ice sheet in coastal Maine, *in* Larson, G. J. and Stone, B. D. (eds.), Late Wisconsinan glaciation of New England: Kendall Hunt, Dubuque, Iowa, p. 211-228.

Thompson, W. B., and Borns, H. W. Jr., 1985a, Surficial geologic map of Maine: Maine Geological Survey, 1:500,000-scale map.

Thompson, W. B., and Borns, H. W. Jr., 1985b, Till stratigraphy and late Wisconsinan deglaciation of southern Maine: A review: Geographie Physique et Quaternaire, v. 39, no. 2, p. 199-214.