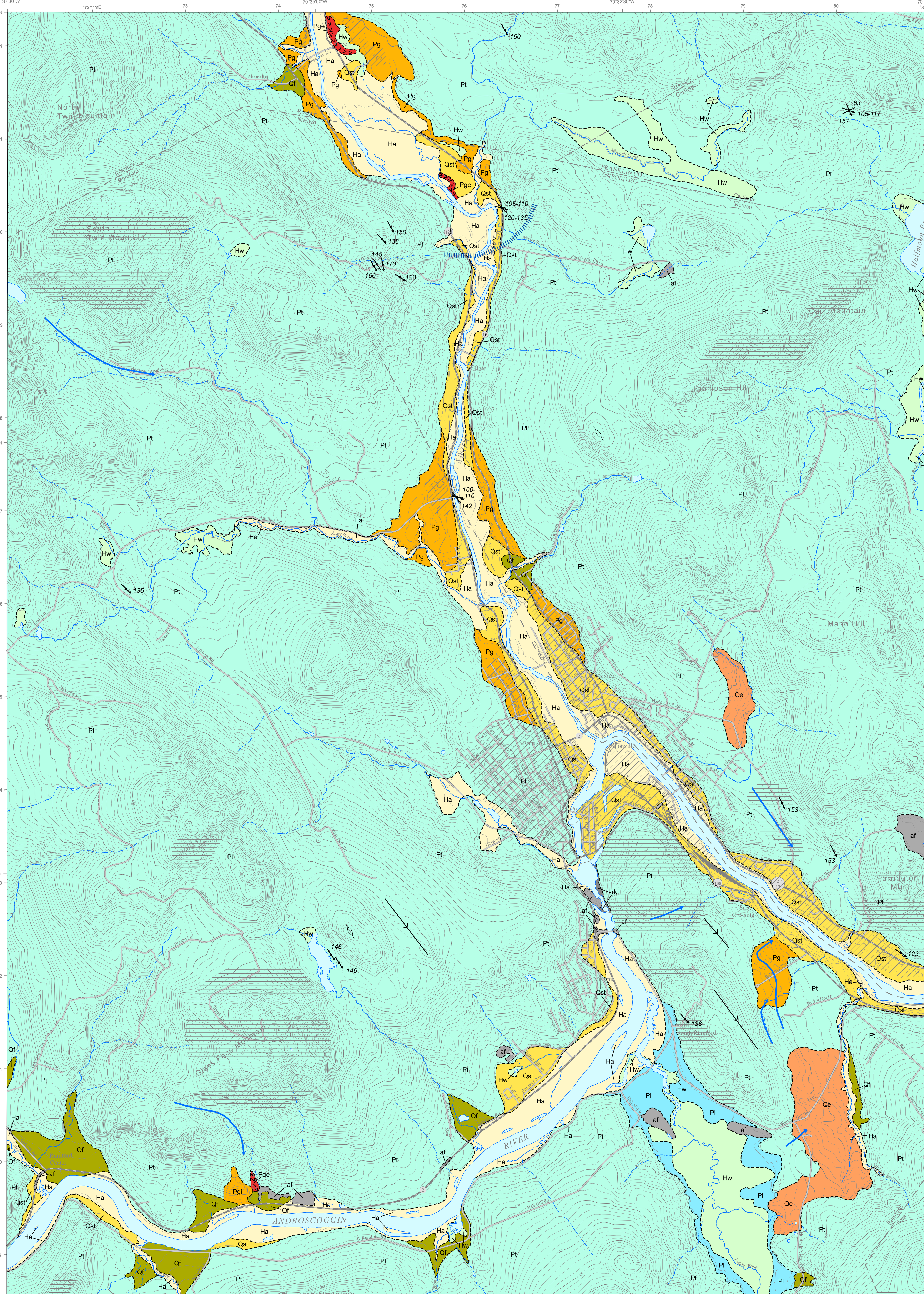
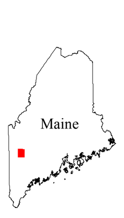
Surficial Geology



SOURCES OF MAP INFORMATION

Surficial geologic mapping of the Rumford quadrangle was conducted by Thomas K. Weddle, Daniel B. Locke, and Lindsay J. Spigel during the 2016-2017 field seasons. Additional information provided by Woodrow B. Thompson from reconnaissance work in 1982-1984 and 1989. Geology of remote or inaccessible areas was interpreted from aerial imagery and/or lidar topographic data.

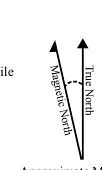


Ellis Pond	Roxbury	Weld
East Andover	Rumford	Dixfield
Bryant Pond	Mount Zircon	Worthley Pond

SCALE 1:24,000

1 Mile; 7000 Feet; 1 Kilometer

CONTOUR INTERVAL 20 FEET



Approximate Mean Declination, 2015
16.5° W (not to scale)

Base map features from Maine Office of GIS - 1:24,000 USGS contour lines, E911 roads, 1:24,000 National Hydrography Dataset, USGS GNIS placenames and 1:24,000 political boundaries. Map projection Universal Transverse Mercator, North American Datum, 1927.

The use of industry, firm, or local government names on this map is for location purposes only and does not impute responsibility for any present or potential effects on the natural resources.

Note: The first letter of each map unit indicates the general age of the unit:
H = Holocene (postglacial deposit; formed during the last 11,700 years).
Q = Quaternary (deposit of uncertain age; usually late-glacial and/or postglacial).
P = Pleistocene (deposit formed during glacial to late-glacial time, prior to 11,700 yr B.P. [years before present]).

Ha **Stream alluvium** - Sand, gravel, silt, and organic sediment deposited on floodplains. May include wetland deposits or underlie some of the mapped wetland areas along streams.

Hw **Wetland deposits** - Peat, muck, silt, and clay deposits in poorly drained areas. Map unit may also include some alluvial sediments along stream valleys.

Qst **Stream terraces** - Sand and gravel deposits in the Swift and Androscoggin River valleys created by fluvial reworking of glacial deposits. Some areas may still be subject to flooding, but most have been abandoned by the modern stream processes.

Qf **Alluvial fan deposits** - Sand, gravel, and silt deposited where higher energy streams meet more subdued topography, such as the Androscoggin River floodplain. Likely formed by the reworking and transport of till deposits by water flowing over a barren landscape in early post-glacial times.

Qe **Eolian deposits** - Windblown sand and silt derived from glacial lake and fluvial deposits in the Swift River, Androscoggin River, and Logan Brook valleys. Deposits lack dune morphology and tend to be relatively thin (1-2 feet thick) and massive. Smaller unmapped areas of eolian sediments may occur elsewhere in the quadrangle.

Pl **Glacial lake deposits** - Sand, gravel, silt, and clay deposited in the Logan Brook valley, which was likely dammed by remnant ice or till deposits in the Androscoggin valley. Lake level may have been controlled by a spillway in the saddle between the Logan and Wyman Brook valleys at 680-700 feet. The lake may have extended north into the Androscoggin valley, but deposits have probably been reworked by fluvial processes in this narrow stretch of the valley.

Pg **Glacial meltwater deposits** - Sand and gravel deposited in the Swift River valley. Origin uncertain - may be outwash or ice contact deposits.

Pgi **Ice-contact deposits** - Miscellaneous sand and gravel deposited in contact with remnant glacial ice.

Pge **Esker deposits** - Sand and gravel deposited by meltwater streams in subglacial tunnels in the Swift and Androscoggin River valleys.

Pt **Till** - Loose to very compact, poorly sorted, massive to weakly stratified mixture of sand, silt, and gravel-size rock debris deposited by glacial ice. May include lenses of water-laid sand and gravel. Scattered boulders on surface are common.

rk **Bedrock** - Significant areas of exposed bedrock at Rumford Falls.

af **Artificial fill** - Variable mixtures of earth, rock, and/or man-made materials used as fill for roads. Usually shown only where large enough to affect the contour pattern on the topographic map.

Bedrock outcrops/thin-drift areas - Ruled pattern indicates areas where bedrock outcrops are common and/or surficial sediments are generally less than 10 ft thick. Mapped from air photos and ground observations. Actual thin-drift areas are probably more extensive than shown.

Disturbed areas - Ruled pattern indicates areas that have been reworked or altered by urbanization or extensive mining. Units in these areas may include zones of artificial fill and/or may not reflect the geological processes that created them.

Contact - Boundary between map units. Most contacts are approximately located and therefore indicated by dashed lines.

Meltwater channel - Channel eroded by a glacial meltwater stream. Arrow shows inferred direction of water flow.

>>>>>> **Axis of esker** - Alignment of symbols shows trend of esker. Chevrons point in direction of former glacial meltwater flow.

Ice-margin position - Shows the approximate position of a portion of the glacier margin during ice retreat based on meltwater deposits.

Fluted landform - Narrow ridge shaped by flow of glacial ice. Symbol indicates approximate length and direction of the ridge crest, which is parallel to former ice-flow direction. Landforms were mapped with lidar topographic data and, therefore, may not match the coarser resolution of the topographic contours on this map.

125 **Glacial striation locality** - Arrow shows ice-flow direction(s) inferred from striations on bedrock. Dot marks point of observation. Number is azimuth (in degrees) of flow direction.

140 **Crescentic mark** - Crescent points in direction of ice flow inferred from gouges in bedrock. Dot marks point of observation. Number is azimuth (in degrees) of flow direction.

Glacially streamlined hill - Symbol shows long axis of hill or ridge shaped by flow of glacial ice, and which is parallel to former ice-flow direction.

USES OF SURFICIAL GEOLOGY MAPS

A surficial geology map shows all the loose materials such as till (commonly called hardpan), sand and gravel, or clay, which overlie solid ledge (bedrock). Bedrock outcrops and areas of abundant bedrock outcrops are shown on the map, but varieties of the bedrock are not distinguished (refer to bedrock geology map). Most of the surficial materials are deposits formed by glacial and deglacial processes during the last stage of continental glaciation, which began about 25,000 years ago. The remainder of the surficial deposits are the products of postglacial geologic processes, such as river floodplains, or are attributed to human activity, such as fill or other land-modifying features.

The map shows the areal distribution of the different types of glacial features, deposits, and landforms as described in the map explanation. Features such as striations and moraines can be used to reconstruct the movement and position of the glacier and its margin, especially as the ice sheet melted. Other ancient features include shorelines and deposits of glacial lakes or the glacial sea, now long gone from the state. This glacial geologic history of the quadrangle is useful to the larger understanding of past earth climate, and how our region of the world underwent recent geologically significant climatic and environmental changes. We may then be able to use this knowledge in anticipation of future similar changes for long-term planning efforts, such as coastal development or waste disposal.

Surficial geology maps are often best used in conjunction with related maps such as surficial materials maps or significant sand and gravel aquifer maps for anyone wanting to know what lies beneath the land surface. For example, these maps may aid in the search for water supplies, or economically important deposits such as sand and gravel for aggregate or clay for bricks or pottery. Environmental issues such as the location of a suitable landfill site or the possible spread of contaminants are directly related to surficial geology. Construction projects such as locating new roads, excavating foundations, or siting new homes may be better planned with a good knowledge of the surficial geology of the site.

SOURCES OF RELATED INFORMATION

Locke, Daniel B., Weddle, Thomas K.,Prescott, Glenn C., Jr. (compilers), 2017, Surficial materials of the Rumford quadrangle, Maine: Maine Geological Survey, Open-File Map 17-6, map, scale 1:24,000.

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

Rumford Quadrangle, Maine

Surficial geologic mapping by
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SURFICIAL GEOLOGY OF MAINE

Continental glaciers like the ice sheet now covering Antarctica probably extended across Maine several times during the Pleistocene Epoch, between about 2.5 million and 11,700 years ago. The slow-moving ice superficially changed the landscape as it scraped over mountains and valleys (**Figure 1**), eroding and transporting boulders and other rock debris for miles (**Figure 2**). The sediments that cover much of Maine are largely the product of glaciation. Glacial ice deposited some of these materials, while others washed into the sea or accumulated in meltwater streams and lakes as the ice receded. Earlier stream patterns were disrupted, creating hundreds of ponds and lakes across the state. The map at left shows the pattern of glacial sediments in this quadrangle.

The most recent "Ice Age" in Maine began about 30,000 years ago, when an ice sheet spread southward over New England (Stone and Borns, 1986). During its peak, the ice was several thousand feet thick and covered the highest mountains in the state. The weight of this huge glacier actually caused the land surface to sink hundreds of feet. Rock debris frozen into the base of the glacier abraded the bedrock surface over which the ice flowed. The grooves and fine scratches (striations) resulting from this scraping process are often seen on freshly exposed bedrock, and they are important indicators of the direction of ice movement (**Figure 3**). Erosion and sediment deposition by the ice sheet combined to give a streamlined shape to many hills, with their long dimension parallel to the direction of ice flow. Some of these hills (drumlins) are composed of dense glacial sediment (till) plastered under great pressure beneath the ice (**Figure 4**).

A warming climate forced the ice sheet to start receding as early as 21,000 calendar years ago, soon after it reached its southernmost position on Long Island (Ridge, 2004). The edge of the glacier withdrew from the continental shelf east of Long Island and reached the present position of the Maine coast by about 16,000 years ago (Borns and others, 2004). Even though the weight of the ice was removed from the land surface, the Earth's crust did not immediately spring back to its normal level. As a result, the sea flooded much of southern Maine as the glacier retreated to the northwest. Ocean waters extended far up the Kennebec and Penobscot valleys, reaching present elevations of up to 420 feet in the central part of the state.

Great quantities of sediment washed out of the melting ice and into the sea, which was in contact with the receding glacier margin. Sand and gravel accumulated as deltas and submarine fans where streams discharged along the ice front, while the finer silt and clay dispersed across the ocean floor. The shells of clams, mussels, and other invertebrates are found in the glacial-marine clay that blankets lowland areas of southern Maine. Ages of these fossils tell us that ocean waters covered parts of Maine until about 13,000 years ago. The land rebounded as the weight of the ice sheet was removed, forcing the sea to retreat.

Meltwater streams deposited sand and gravel in tunnels within the ice. These deposits remained as ridges (eskers) when the surrounding ice disappeared (**Figure 5**). Maine's esker systems can be traced for up to 100 miles, and are among the longest in the country.

Other sand and gravel deposits formed as mounds (kames) and terraces adjacent to melting ice, or as outwash in valleys in front of the glacier. Many of these water-laid deposits are well layered (**Figure 6**), in contrast to the chaotic mixture of boulders and sediment of all sizes (till) that was released from dirty ice without subsequent reworking. Ridges consisting of till or washed sediments (moraines) were constructed along the ice margin in places where the glacier was still actively flowing and conveying rock debris to its terminus. Moraine ridges are abundant in the zone of former marine submergence, where they are useful indicators of the pattern of ice retreat.

The last remnants of glacial ice probably were gone from Maine by 12,000 years ago. Large sand dunes accumulated in late-glacial time as winds picked up outwash sand and blew it onto the east sides of river valleys, such as the Androscoggin and Saco valleys (**Figure 7**). The modern stream network became established soon after deglaciation, and organic deposits began to form in peat bogs, marshes, and swamps. Tundra vegetation bordering the ice sheet was replaced by changing forest communities as the climate warmed (Davis and Jacobson, 1985). Geologic processes are by no means dormant today, however, since rivers and wave action modify the land (**Figure 8**), and worldwide sea level is gradually rising against Maine's coast.

References

Borns, H. W., Jr., Doner, L. A., Dorion, C. C., Jacobson, G. L., Jr., Kaplan, M. R., Kreutz, K. J., Lowell, T. V., Thompson, W. B., and Weddle, T. K., 2004, The deglaciation of Maine, U.S.A., *in* Ehlers, J., and Gibbard, P. L., eds., Quaternary Glaciations – Extent and Chronology, Part II: North America: Amsterdam, Elsevier, p. 89-109.

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Stone, B. D., and Borns, H. W., Jr., 1986, Pleistocene glacial and interglacial stratigraphy of New England, Long Island, and adjacent Georges Bank and Gulf of Maine, in Sibrava, V., Bowen, D. Q., and Richmond, G. M. (editors), Quaternary glaciations in the northern hemisphere: Quaternary Science Reviews, v. 5, p. 39-52.

Figure 1: A west-facing view of North Twin Mountain from Route 17 in Roxbury. This landform was shaped by glacial action, which abraded the gentle north slope (right) and plucked bedrock from the south side (left) to create a steep slope.

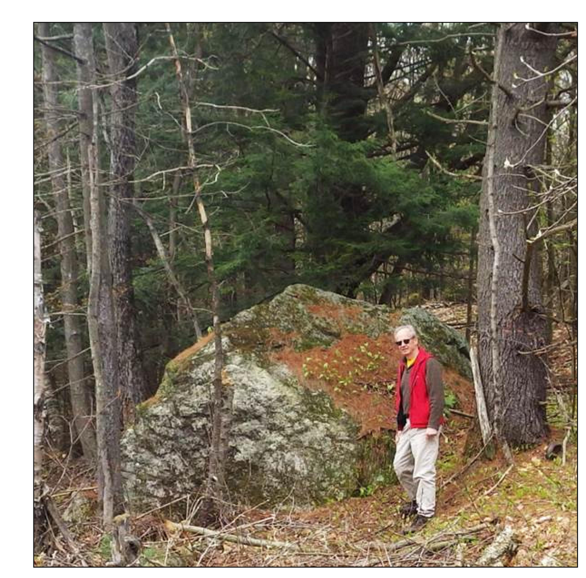

Figure 2: A glacially transported boulder near Route 108 and Wyman Hill Road in Rumford.

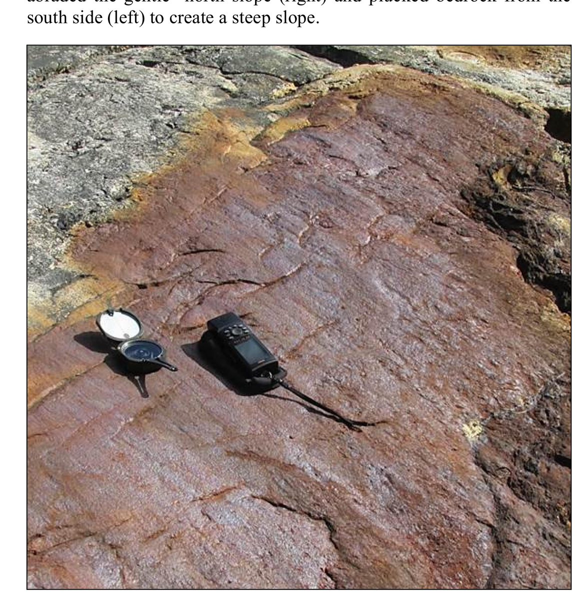

Figure 3: Glacial striations on a bedrock exposure in Rumford, which show that ice was flowing from northwest (top left) to southeast (bottom right). The red hue of the rock is due to oxidation.

Figure 4: A sandy till exposure in a small borrow pit in Rumford. This chaotic mix of sediments is a sharp contrast to the fluvial deposits shown below in Figure 6.

Figure 5: Short esker ridge along Route 17 in Roxbury (looking south).

Figure 6: A small exposure (about 8 feet) in Mexico of younger sandy alluvium over older gravel that was likely deposited by glacial meltwater streams.

Figure 7: A thin deposit (about 2 feet) of windblown sand in Mexico. This sand probably originated in the barren early post-glacial Androscoggin valley, and settled out in the wind shadow of a nearby hill to the east.

Figure 8: View of the Androscoggin River, looking southwest towards Thurston Mountain in the south-central portion of the quadrangle. Fluvial action dominates modern geological processes in this region. Note the exposed sandy area where the river is eroding the outside of a bend (cut bank).