

# Surficial Geology

# Mount Zircon Quadrangle, Maine

Surficial geologic mapping by  
**Woodrow B. Thompson**

Digital cartography by:  
**Susan S. Tolman**

**Robert G. Marvinney**  
State Geologist

Cartographic design and editing by:  
**Robert D. Tucker**

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**Maine Geological Survey**  
Address: 22 State House Station, Augusta, Maine 04333  
Telephone: 207-287-2801 E-mail: mgs@maine.gov  
Home page: http://www.maine.gov/doc/nrmc/nrmc.htm

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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 1.5 million and 10,000 years ago. The slow-moving ice superficially changed the landscape as it scraped over mountains and valleys, eroding and transporting boulders and other rock debris for miles. The sediments that cover much of Maine are largely the product of glaciation. Glacial ice deposited some of these materials, while others were 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 the Mount Zircon 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 surfaces 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. 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.

A warming climate forced the ice sheet to start retreating 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 retreating 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.

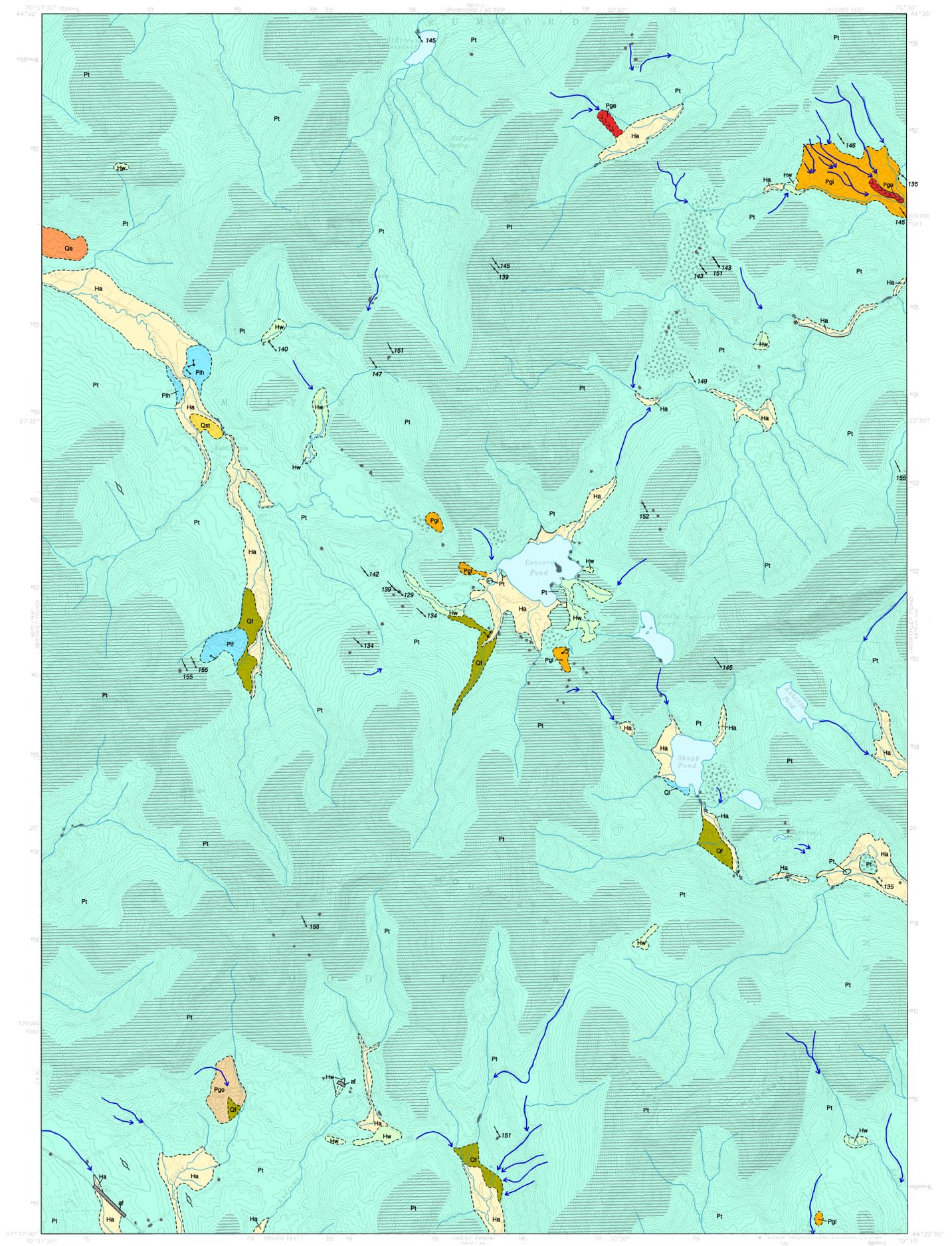
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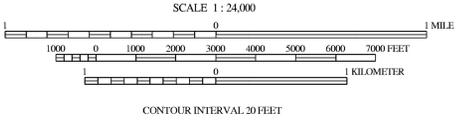
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### SOURCES OF INFORMATION

Surficial geologic mapping of the Mount Zircon quadrangle was conducted by Woodrow B. Thompson in 1984 for the Maine Geological Survey's sand and gravel aquifer mapping program and in 2007 for the STATEMAP program. Additional data were collected during the 1980's and 1990's by W. B. Thompson.



Topographic base from U.S. Geological Survey Mount Zircon quadrangle, scale 1:24,000 using standard U.S. Geological Survey topographic map symbols.

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

- Ha** Stream alluvium - Sand, silt, gravel, and organic sediment. Deposited on flood plains of streams. Unit includes some wetland areas, and may also include low terraces that are not flooded often.
- Hw** Wetland deposits - Peat, muck, silt, and clay. Deposited in poorly drained areas on valley floors. Unit may grade into or include areas of stream alluvium.
- Qst** Stream terrace - Sand and gravel terrace in the Concord River valley. Formed by postglacial erosion and deposition along the river. The terrace consists of sediments deposited by the river when it flowed at a higher level than today.
- Qf** Alluvial fans - Gravel and sand deposited near the mouth or along the lower reaches of brooks that drain steep upland terrain. The fans have accumulated where the stream gradients become gentler and the coarsest sediments cannot be carried farther downstream. The fan surfaces usually have steeper slopes than unit Ha. Some of these deposits may have begun to form in late-glacial time, and today they may not be flooded except (in some places) during extreme storm events.
- Ql** Lake deposit - Low, flat area underlain by sand, on south side of Shagg Pond. Probably deposited into Shagg Pond when the water level was higher than at present.
- Qe** Eolian deposit - Windblown sand derived from glacial-lake sediments in the Bryant Pond quadrangle (west of Mount Zircon quad). Small unmappped areas of eolian sand may occur elsewhere in the quadrangle.
- Pgo** Outwash deposit - Gravel deposited by glacial meltwater in the valley just south of Spruce Mountain.
- Pih** Glacial Lake Hanover deposits - Sand and gravel deposited in glacial Lake Hanover. One arm of this former lake is thought to have extended up the Concord River valley from the adjacent Bryant Pond quadrangle. Unit Pih includes deltaic and lake-bottom sediments which have been partly eroded by the Concord River. The lake probably was dammed by till deposits that temporarily blocked a narrow portion of the Androscoggin River valley in the Rumford Center area. Pih deposits in the Bryant Pond quad suggest the lake level reached elevations as high as 780 ft.
- Pif** Glaciolacustrine fan deposit - Sand and gravel deposited in a small ice-dammed glacial lake in the valley east of Chamberlain Mountain. A very short ridge of sand and gravel extends uphill (southwest) from the fan and marks the path of a glacial stream that fed the deposit.
- Pgc** Ice-contact deposits - Miscellaneous sand and gravel deposits formed in contact with remnants of glacial ice.

- Pge** Esker deposits - Sand and gravel deposited by meltwater streams in subglacial tunnels.
- 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. Locally includes lenses of waterlain sand and gravel.
- Pw** Bedrock outcrops/thin-drift areas - Ruled pattern indicates areas where outcrops are common and/or surficial sediments are generally less than 10 ft thick. These areas were mapped largely from air photos, especially in remote parts of the quadrangle, and probably are more extensive than shown. Dots show individual outcrops.
- af** Artificial fill - Earth, rock, and/or man-made fill along roads.
- Contact - Boundary between map units. Dashed where approximately located.
- |—** Glacially streamlined hill - Symbol shows trend of long axis, which is parallel to former glacial ice-flow direction.
- ↖** Glacial striation locality - Arrow shows ice-flow direction inferred from striations on bedrock. Dot marks point of observation. Number is azimuth (in degrees) of flow direction.
- ↘** Dip of cross-bedding - Arrow shows average dip direction of cross-bedding in sand and gravel deposits formed in a glacial stream or lake. This usually is the direction of meltwater flow (in stream deposits) or the direction in which a delta or subaqueous fan was building into a lake. Dot marks point of observation.
- Meltwater channel - Channel eroded by glacial meltwater stream or outflow from glacial lake. Arrow shows inferred direction of water flow.
- >>>>** Crest of esker - Shows trend of esker ridge. Chevrons point in direction of glacial meltwater flow.
- Area of large boulders - Area of glacial till where there are many large boulders, typically 3-5 ft or larger, scattered over the ground surface. These areas have been mapped only where observed, and they are likely to occur elsewhere in the till-covered uplands.

### 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 aquifers 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. Refer to the list of related publications below.

### OTHER SOURCES OF INFORMATION

- Thompson, W. B., and Locke, D. B., 2008. Surficial materials of the Mount Zircon quadrangle, Maine: Maine Geological Survey, Open-File Map 08-17.
- Neil, C. D., 1998. Significant sand and gravel aquifers of the Mount Zircon quadrangle, Maine: Maine Geological Survey, Open-File Map 98-209.
- Thompson, W. B., 1979. Surficial geology handbook for coastal Maine: Maine Geological Survey, 68 p. (out of print).
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Figure 1: View south across Shagg Pond from Bald Mountain, showing the rugged topography of the Mount Zircon quadrangle.



Figure 2: Step ledges on the south face of Speckled Mountain. These cliffs resulted from plucking of bedrock by glacial ice flowing southeast over the mountain.



Figure 3: Weathered glacial grooves just northeast of the summit of Mount Zircon. As the ice flowed southeast (right to left) over this ledge, rock debris in the base of the glacier abraded the bedrock surface and produced the parallel grooves and smooth profile.



Figure 4: Glacially transported boulders on hillside northwest of Concord Pond.



Figure 5: Stony glacial till (map unit Pt) with lenses of sand and gravel, exposed in pit near northeast corner of the quadrangle. The pit face is approximately 30 ft high.



Figure 6: Pit exposure on hillside between Spruce Mountain and Black Brook in southwest part of quadrangle. The lower unit is glacial till. The upper unit is rusty gravel (map unit Pgo) which is inferred to be a glacial outwash fan deposited by meltwater runoff from the side of Spruce Mountain.



Figure 7: Deltaic sand and gravel in pit on east side of Concord River valley (map unit Pih). The delta probably was built by water flowing down the valley and depositing sediment into glacial Lake Hanover, which occupied part of the Androscoggin River basin.



Figure 8: Fan deposit (map unit Pif) consisting of sand and gravel that washed into a glacial lake in the valley east of Chamberlain Mountain. The bulldozed surface (center to left-center) generally conforms to the original slope of the fan surface. The head of the fan is in the upper-left part of photo.