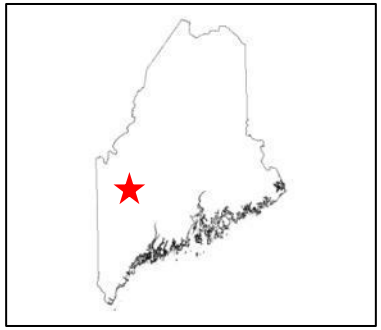
Maine Geologic Facts and Localities

April, 1998

A Geological Tour of Tumbledown Mountain, Maine



44° 45‘ 3.21“ N, 70° 32‘ 50.24“ W

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Introduction

On any given fine-weather day in any of the four seasons, Tumbledown Mountain in Township 6 North of Weld (Figure 1), is visited by scores of people; most in pursuit of the excellent views afforded by the bald peaks, and perhaps a few mistakenly seeking the solitude of a wilderness experience. While a few individuals may come specifically to look at the beautifully exposed bedrock here, over the course of an outing almost every visitor will develop some interest in the rocks if for no other reason than its near constant exposure along some of the popular summit trails.

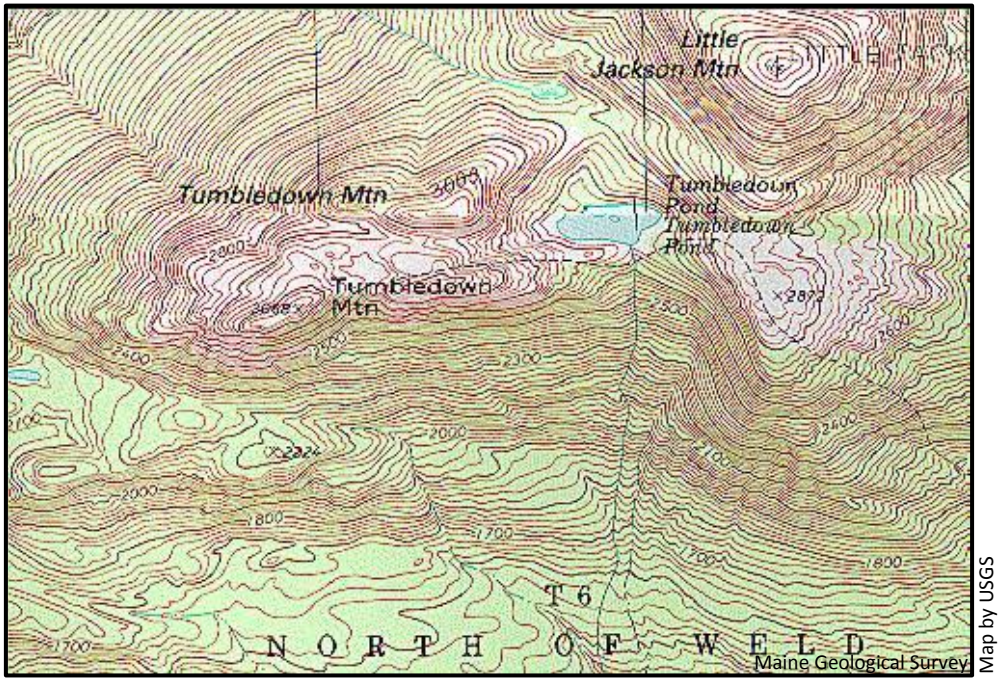

Figure 1. Topographic map of Tumbledown Mountain

Tumbledown Mountain

It is easy to guess the origin of the name "Tumbledown" simply by viewing the south side of the mountain from any of the trails that lead to the summit. Cliffs of several hundred feet bear the scars, old and new, of rock slides that have left piles of rubble (talus) at their bases (Figure 2).

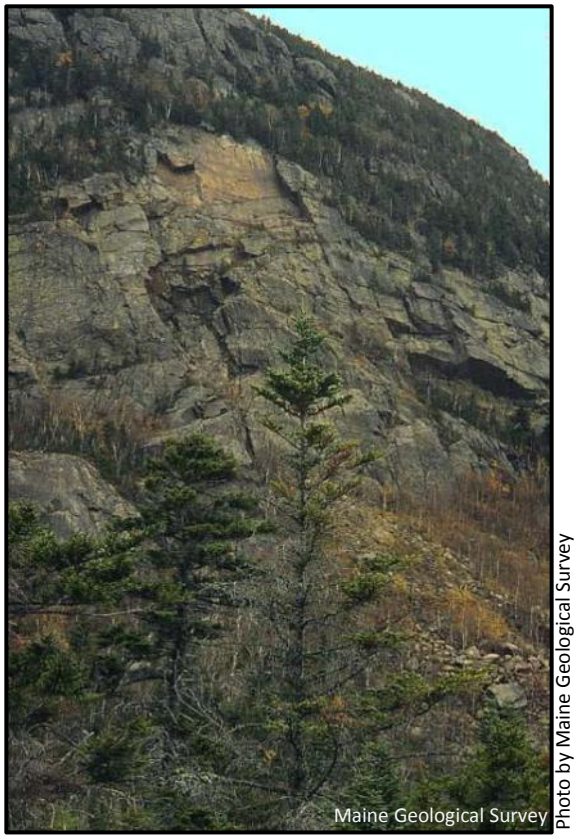

Figure 2. The south face of Tumbledown showing the scar of a recent rock slide on the cliff bounded by vertical fractures (joints) in the rock.

Bedrock Geology

Western Maine is underlain by a regular sequence of layered metamorphic rocks which began their existence as layers of sand and mud on the edge of an ocean basin about 430 million years ago. As these sediments accumulated over millions of years, through a number of processes they gradually hardened into sandstone and shale. During the last great mountain building event that helped form the northern Appalachians about 415 million years ago, these layers were folded, thrust upward, and heated. Great masses of molten rock formed at depth and moved upward through the contorted layers of rock, cooling into solid rock some distance below the surface. Hundreds of millions of years of erosion have now exposed the resulting granites and granodiorites at the surface of the earth.

Bedrock Geology

Let's look at some examples of these rocks. Figure 3 is a photograph showing some of the thinner layers of schist and granofels that can be found near Tumbledown Pond. The lighter layers are quartz-feldspar granofels, and the darker layers are andalusite schist. Note that while each light layer begins with a very sharp boundary on the right, there is only a gradual change to the corresponding dark layer on the left.

Figure 3. Thinly layered dark schist and light granofels exposed at Tumbledown Pond.

Bedrock Geology

This is a characteristic carried over from the sedimentary origins of the rock and is referred to as graded bedding. When the sediments that formed this rock were deposited, the actions of water flow were such that the coarser sand grains (quartz and feldspar) fell to the bottom first, followed by progressively smaller grains. Deposited last during each sedimentary event were very small grains of clay, before the next slug of sediment came down and the process began anew. Geologists use graded beds to determine which direction was originally up in the layers. This is important in determining which are the younger rocks in a sequence. Through the process of metamorphism, the quartz and feldspar grains changed little, but the clay grains changed into a variety of minerals including micas, staurolite, and andalusite, the coarsest grains in the rocks today. So, while the grain size of the sediment originally changed from coarse to fine as one moved from right to left in each bed, the grain size change of the metamorphic minerals is just the opposite.

Bedrock Geology

There is a good deal of variability in the thickness of layers at Tumbledown. Figure 4 shows some of the most striking layering exposed near the summit. In many places the layers are several feet thick and continuous for hundreds of feet. In several places on the mountain, large folds are exposed.

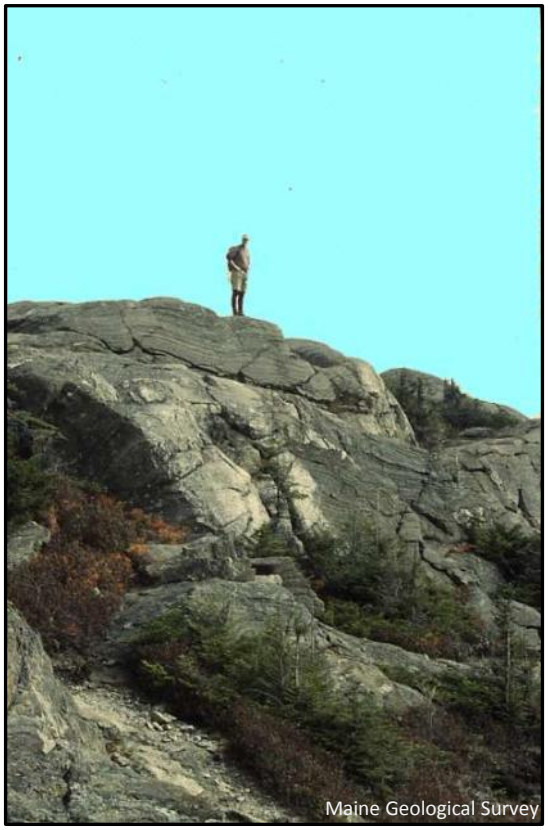

Photo by Maine Geological Survey

Figure 4. Continuous layers of variable thickness exposed on the summit of Tumbledown. This south-facing wall was formed through plucking of rocks by glacial ice. The north slope behind Henry was smoothly rounded by glacial ice.

Bedrock Geology

One of the best examples is between Tumbledown Pond and the eastern summit of Tumbledown Mountain (Figure 5). These folds developed at the time the northern Appalachians were forming, when the rocks today at the surface were at considerable depth and subject to higher temperatures and pressures which were not uniform in all directions. Both sides (limbs) of the fold are inclined in the same direction in what geologists term an overturned fold.

Photo by Maine Geological Survey

Figure 5. Folds in layered metamorphic rocks. Both an antiform (a fold that closes at the top) and a synform (a fold that closes at the bottom) are visible in this photograph. Note that because the sides or limbs of these folds are all inclined toward the left (south), they are classified as overturned folds.

Topography

Some who have ventured to Tumbledown have interpreted the shape of the mountain and the pond nestled among the peaks to be volcanic in origin. While this certainly is an exciting idea, it simply isn't true. As we've already explained, the rocks were formed in a sedimentary basin and are not at all volcanic in nature. The landscape or topography is also not of volcanic origin but formed through the interaction of several processes. The first important factor in defining the topography is the nature of the bedrock, here composed of metamorphic rocks and granite intrusions.

Topography

From the top of Tumbledown, a most striking feature of the landscape is the ring of mountains the completely encircle Webb Lake to the south (Figure 6).

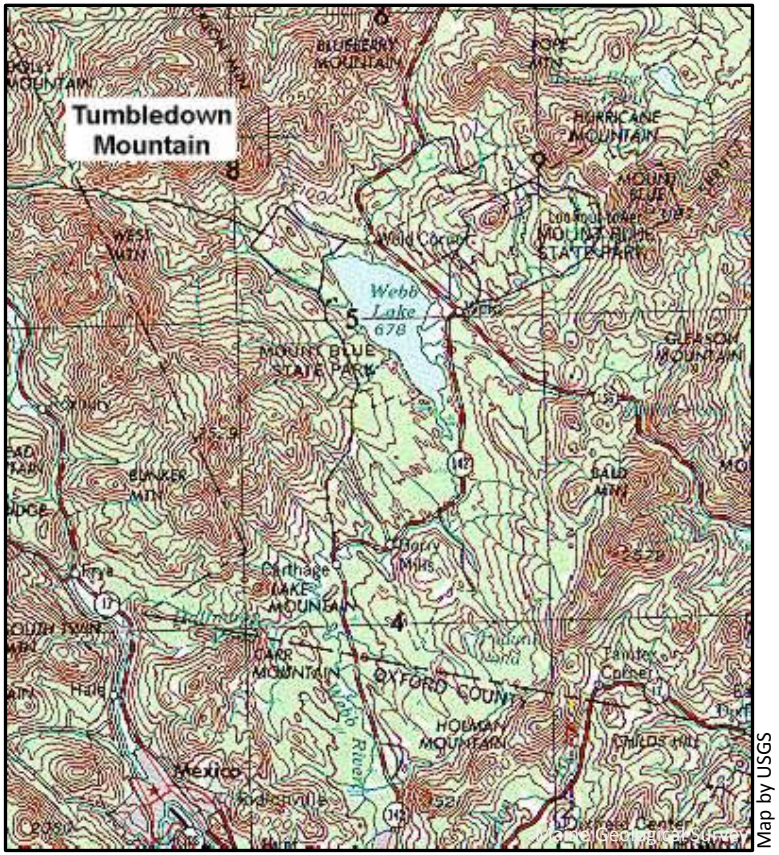

Figure 6. This section of the smaller scale map of the region shows the ring of mountains around Webb Lake. The lake is underlain by easily eroded granite while the ring of mountains is underlain by less erodable metamorphic rocks.

Topography

Webb Lake is underlain by granite while the ring of mountains is underlain by metamorphic rocks. In particular, these metamorphic rocks were subjected to even greater heat as the originally molten granite was intruded into them. One consequence of this process is that the metamorphic rocks immediately surrounding the granite are slightly more resistant to erosion than any of the other rocks. Granite, with its large crystals and abundant feldspar, is actually fairly susceptible to erosion. The result of all this is the ring of mountains underlain by metamorphic rocks, and the basin of Webb Lake, underlain by easily eroded granite. At the Mount Blue State Park visitor's center there is a plaster model of the landscape which illustrates this ring of mountains well.

The greatest agent of erosion is the glaciers which swept over the landscape just a few tens of thousands of years ago and represent the second most important factor in defining the topography. As the glaciers progressed across the landscape in a southeasterly direction, they scraped soils and weathered rock off the less erodable rock units and deeply gouged the earth in the more erodable rock units. Due to the complex processes of glacial flow, in many places the glaciers polished the northern slopes of mountains into rounded shapes, while they plucked broken rock without any polishing on the southern slopes of mountains. This is readily apparent in the landscape at Tumbledown.

Topography

On the summit the rocks are well polished, and there are numerous knobs with smoothly rounded surfaces facing north and steep, unrounded surfaces facing south (see Figure 4). Tumbledown Pond itself (Figure 7) was produced by this gouging and plucking action. In many places on the summit, scratches formed by rocks imbedded in the base of the glacier as it advanced across the landscape, point to the northwest from whence the glaciers came.

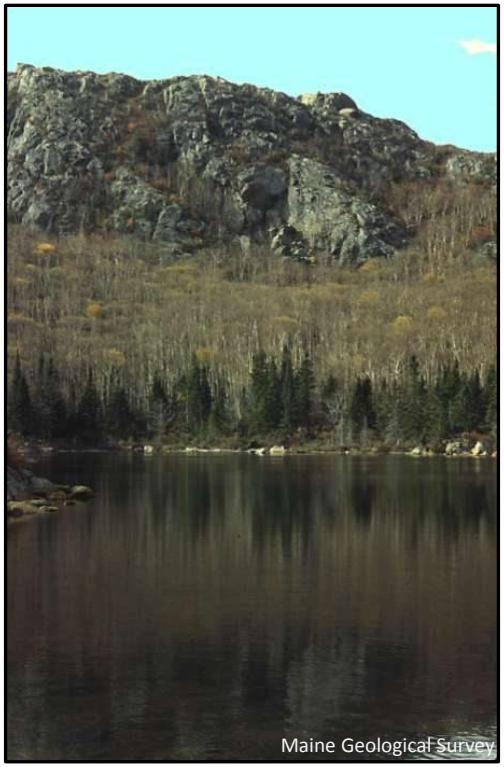

Photo by Maine Geological Survey

Figure 7. Tumbledown Pond in a glacially plucked depression on the mountain. Glacially plucked knobs in background.

Topography

Many trails (Figure 8) provide free public access to the summit and Tumbledown Pond through the auspices and stewardship of the Hancock Timber Resources Group, Inc.

Photo by Maine Geological Survey

Figure 8. Brook Trail leading down from Tumbledown Pond.