

Geologic Site of the Month

October, 2006

***A Geologic Transect along the Appalachian Trail to the Summit of Saddleback Mountain:
A Field Trip from the September-October 2006
New England Intercollegiate Geological Conference***



44° 56' 53.56" N, 70° 29' 30.66" W

Text by
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Introduction

Saddleback Mountain (4120 ft (1255 m)) is one of fourteen Maine mountains higher than four thousand feet. Its bare summit offers spectacular views of Maine's Longfellow Mountains. The hiking trail to the top is a section of the Appalachian National Scenic Trail and is considered to be one of its more demanding sections. The purpose of this field trip is to traverse the Appalachian Trail to the summit of Saddleback Mountain (Figure 1) and examine both bedrock and glacial geology along the way.



Photo by Robert A. Johnston

Figure 1. The summit of Saddleback Mountain looking northeast, with The Horn and Saddleback Junior in the distance.



Saddleback Mountain

The Appalachian National Scenic Trail is a 2,175 mile long trail that runs from Springer Mountain, Georgia to Mt. Katahdin in Baxter State Park in Maine. Each year hundreds of people complete the 2,175 mile hike at the top of Mt. Katahdin, many in late September and early October. A trip up Saddleback at this time of year may be a little late to see the "thru-hikers" on the Appalachian Trail as Saddleback Mountain is about 220 miles southwest of Baxter Peak.

The Appalachian Trail to the summit of Saddleback Mountain is a 5.7-mile, strenuous hike. AMC Maine Mountain Guidebook time for the hike up the mountain is 3 hours and 45 minutes. There is no drinking water available on the trail (unless treated) so all food and drink must be carried with you. Hikers should also carry a warm jacket, hat, gloves, and raingear. Over a mile of the trail near the top of the mountain is above tree line so in late September the potential for cold, windy, wet conditions is great. Lower sections of the trail can also be very wet underfoot so adequate hiking footwear is recommended. One primitive privy is located at the Piazza Rock lean-to.



Road Log

The meeting place for the hike up the Appalachian Trail to the summit of Saddleback Mountain is the parking lot on the west side of Route 4; 9.9 miles south from the junction of ME Routes 4/16 in Rangeley or 32 miles north of the intersection of ME Routes 4 and 2 in Farmington (Figure 2). The parking lot and Appalachian Trail crossing point on Route 4 is on a steep and winding section so care should be taken in both entry and exit of the parking lot and in crossing Route 4 on foot. As a courtesy to other hikers it would be best to carpool whenever possible (the lot holds approximately 16 cars).

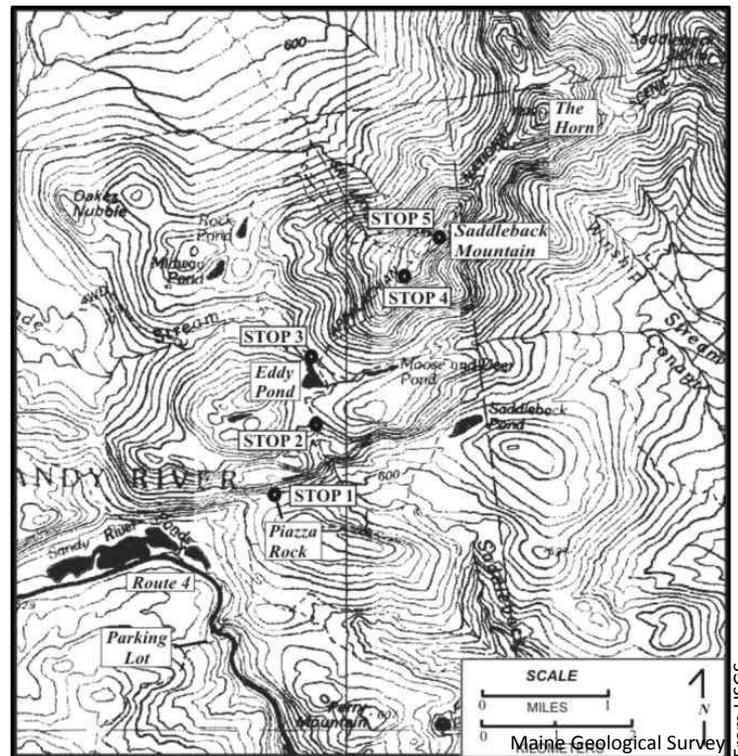


Figure 2. Location map showing field trip stops along the Appalachian Trail.



The Geology of Saddleback Mountain

Saddleback Mountain is composed largely of a two-mica granodiorite, a coarse-grained plutonic rock named the Redington pluton (Moench, 1971). Surrounding the Redington pluton are metamorphic rocks, the Rangeley and Perry Mountain Formations, initially deposited as proximal and distal marine sediments, respectively. The Rangeley Formation is a metamorphosed sandstone and conglomerate, while the Perry Mountain is a fine-grained sandstone and shale. We will examine outcrops of both the Redington pluton and the Rangeley Formation on the field trip.

Large areas of thin drift (less than 10 ft to bedrock) dominate the glaciated landscape. Till, a heterogenous mixture of sand, silt, clay, and stones, overlies much of the bedrock in the areas below the exposed mountain summits. Bedrock outcrops at higher altitudes show few ice direction features due to the erosive nature of the environment above tree line.



Previous Work

C. T. Jackson, during investigations for his Third Annual Report on the Geology of the State of Maine (1839), climbed nearby Mount Abraham and recorded ice flow direction features ("diluvial scratches are very distinctly seen on the top of Mt. Abraham, and run in a N. W. and S. E. direction"). Jackson also noted the metashale and metasandstone on his hike (now called the Perry Mountain Formation (Moench, 1971)). Hitchcock, in his General Report Upon the Geology of Maine (1861), discussed the conglomerate now known as the Rangeley Formation and also recorded ice flow directions in this mountainous area of the State. Another early bedrock study was The Rangeley Conglomerate (Smith, 1923), in which the author described three well-defined sedimentary units within the Rangeley rock type.

The most detailed mapping work done to date was done by Moench (1971), who mapped the Rangeley and Phillips 15-minute quadrangles, publishing a detailed map of the units within the Rangeley Formation, other metamorphic rocks, and the intruded plutonic rocks. Moench and Boudette (1988) synthesized the stratigraphy and sedimentology of the Rangeley area and provided approximate ages for the various units.

Caldwell (1975) mapped the surficial geology of the region. Sand and gravel aquifers were mapped in the region in 1989 and 2001 (Nichols and others, 1995; Foster and others, 2001).



Bedrock Geology

The Rangeley Formation marine facies rocks were deposited during the Llandoveryian stage of the Silurian Period, between 428 and 443 years before present. The metasandstones and metaconglomerates are interpreted to have been deposited in a proximal marine setting (Moench, 1971). The Rangeley Formation is an interstratified marine shale, sandstone, and conglomerate, divided into units B, C, and BC (conglomerate) in our area of interest. The finer-grained, nearby Perry Mountain Formation metasandstone and metashale were deposited in a distal marine environment. The Perry Mountain Formation (Silurian, Wenlock?) is an interbedded, metamorphosed, quartz-rich sandstone or quartzite and potassium-rich shale (Moench, 1971). The unit has been measured to be on the order of 600 m thick in the type locality in the Rangeley quadrangle.

The Devonian-aged Redington pluton intruded into the Rangeley Formation rocks 410 million years before present (Bradley and others, 2000). The heat caused by the emplacement of the Redington pluton, metamorphosed the surrounding Rangeley and Perry Mountain units, making them much more resistant to erosion.



Bedrock Geology

The granodiorite is gray, medium-grained, massive to weakly foliated and contains phenocrysts of microcline from 1.5 to 3 cm long (Figure 3). These phenocrysts are commonly aligned subparallel to contacts. Common accessory minerals are magnetite, apatite, zircon, and scattered garnet.



Figure 3. Redington pluton porphyritic two-mica granodiorite. Note tabular phenocrysts of microcline.

Surficial Geology

Till, a heterogeneous mixture of sand, silt, clay, and stones, covers almost all of the field trip area below tree line (Figure 4). Climbing up out of the Sandy River valley much of the area is mapped as thin drift, where till thickness is generally less than 10 feet (3 m). The direction of glacial striations in the area is from the northwest to the southeast. Evidence of glacial ice movement can be seen in the streamlined shape of bedrock outcrops, glacial erratics scattered across the top of the mountain above tree line, the small glacier-carved lakes along the trail, and the smooth saddles between mountain peaks.



Figure 4. A portion of the Reconnaissance Surficial Geologic Map of the Rangeley 15-minute quadrangle, Maine (Caldwell, 1975) showing the extensive thin-drift deposits in the area of the Appalachian Trail.

Alpine Zone Communities

The typical forest transition to the top of a 4000-foot mountain in New England goes from a northern hardwood forest with maple, beech, and birch up to about 2000 feet where a transition forest begins (Slack, N. G. and Bell, A. W., 2006). This transition forest is composed of a mixture of spruce and fir with fewer numbers of northern hardwoods. The spruce-fir forest zone begins between 2500 and 3000 feet. Colder temperatures, a shorter growing season, and increased moisture availability promote the growth of spruce and fir. Soils are generally wet and more acidic in this zone. Paper birch, mountain ash, and striped maple still survive in these higher elevations.

Above 4000 feet (1219 m) is the balsam fir forest zone. These firs can grow in the poor, thin soils, fog, increased precipitation, and cold temperatures. The balsam fir forest transitions into the krummholz ("crooked wood"), stunted high-altitude clumps of balsam fir and black spruce. Wind appears to be the cause of the shortened height and strange shapes of the trees.



Alpine Zone Communities

Fragile alpine plant communities also exist in this zone above tree line. These plant communities often form alpine "lawns" which are home to a variety of sedges, grasses, rushes, mosses, and lichens (Figure 5). In order to survive, these plants often stay small. Please stay on the trail and follow the white-blazed Appalachian Trail signs to help protect this unique, fragile environment.



Figure 5. Alpine lawn above 4000 feet (1219 m) with krummholz in distance.



Summary

The Appalachian Trail from Maine Route 4 to the summit of Saddleback Mountain traverses an interesting set of bedrock units. The transition from the metamorphosed rocks of the Rangeley Formation to the granitic rocks of the Redington pluton is seen in a sharp contact, except where covered by glacial till. The exposed area above tree line allows for the viewing of evidence of the last glaciation. The view from the summit, on clear days, offers a window into the erosive power of glacial ice. The unique alpine environment is a special place that should be appreciated by all who have worked hard to hike to the summit.



Stop 1. Mile 0.0. Route 4. Appalachian Trail Crossing parking lot

Carefully cross road and head east on Appalachian Trail (AT). At 0.1-mile cross the bridge over the Sandy River and climb up out of the river valley. Follow the white blazes of the Appalachian Trail. Distances to stops are from the AMC Maine Mountain Guide (2005). The first mile or so of the hike will be across the Perry Mountain Formation (Sp); a quartz-rich sandstone and potassium-rich shale (Moench and Pankiwskji, 1988). The Perry Mountain Formation is thought to have formed as turbidite flows in a distal marine environment. Outcrop exposure is limited in the lower sections of the hike due to the thick till cover. Exposures of the till can be seen in stream cuts.

At 1.1-mile cross a gravel logging road. As the AT approaches the brook flowing southwest into the easternmost Sandy River Pond we cross into a thin section of Rangeley Formation, Member C (Src), a gray metamorphosed shale and sandstone which grades into rocks of the Rangeley Formation, Member B (Srb), a stratified shale and sandstone unit. The granodiorite of the Redington pluton (Dgp) is exposed along the south-facing cliff to the left of the Appalachian Trail as we approach and pass Piazza Rock and the Caves. At 1.8 miles arrive at Piazza Rock lean-to, originally built in 1935 by the Civilian Conservation Corps. Piazza Rock (via side trail) is 0.1 miles off the AT.



Stop 2. Mile 1.9. Piazza Rock

Piazza Rock is a huge, flat, overhanging boulder with several large trees growing on top of it. The large boulders encountered at Piazza Rock, the Caves, and along the AT further east are all rockfall boulders of granodiorite (Figure 6). Stop 2a (Mile 2.0) is a series of large boulder caves with narrow passageways.

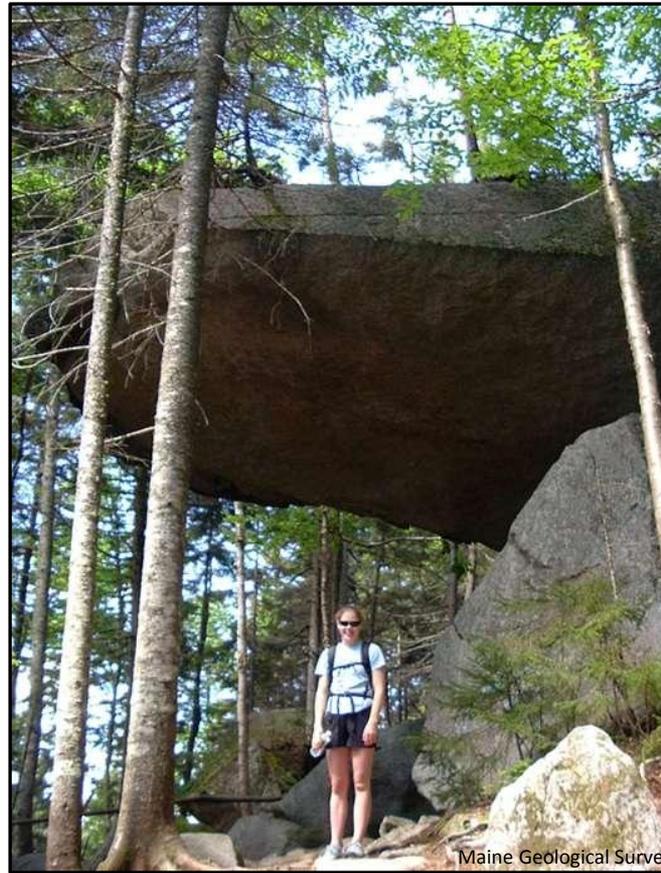


Photo by Robert A. Johnston

Figure 6. Piazza Rock, a large boulder of Redington pluton granodiorite which has fallen from the ledges above.



Stop 3. Mile 3.0. Rangeley Formation sandstone (Src)

North end of Ethel Pond. After climbing up a steep face at the contact with the Redington pluton we cross a contact of Rangeley Formation (Srbc), the conglomerate member. At the north end of Ethel Pond we are back in the granodiorite for about a quarter of a mile before encountering an outcrop of Rangeley Formation (Src), the metamorphosed shale and sandstone (Figure 7).



Figure 7. Exposure of Rangeley Formation, Member C (metamorphosed, stratified sandstone), at Stop 2.

Stop 4. Mile 3.7. Eddy Pond

A glacially sculpted, shallow (23 ft, 7 m) pond. It is listed as the last reliable water supply on the hike (water should be treated before drinking). At Eddy Pond we are back in the Redington pluton, here mapped with just a thin cover of till. The remainder of the hike to the summit is on the granodiorite of the Redington pluton.



Stop 5. Mile 4.4. Tree Line. Alpine zone

Note the small trees, some of which may be well over 50 years old. Above Eddy Pond more and more bedrock exposures are encountered until one reaches tree line at about 3500 feet and there are no more till exposures. Above tree line, evidence of glaciation is seen in the erratic boulders strewn across the bedrock surface, streamlining of bedrock outcrops, and large-scale grooves in the granodiorite.



Stop 6. Mile 5.7. Saddleback Mountain summit (4116 ft (1255 m))

Two-mica granodiorite and various glacial features. Glacial erratics are common on the trail northeast to The Horn (Figure 8). If weather and time permit, hike to the next peak, just east of Saddleback Mountain, for views of the erratics on the trail to The Horn and additional outcrops of the Rangeley Formation (Figure 9). A good lunch stop is the site of the old Maine Forest Service fire tower on the top of Saddleback. From the summit it is 1.6 miles northeast on the Appalachian Trail to the summit of The Horn, another of Maine's four thousand foot tall mountains (4041 ft (1232 m)).



Figure 8. Glacial erratics on the Appalachian Trail between the summits of Saddleback Mountain and The Horn.

Stop 6. Mile 5.7. Saddleback Mountain summit (4116 ft (1255 m))

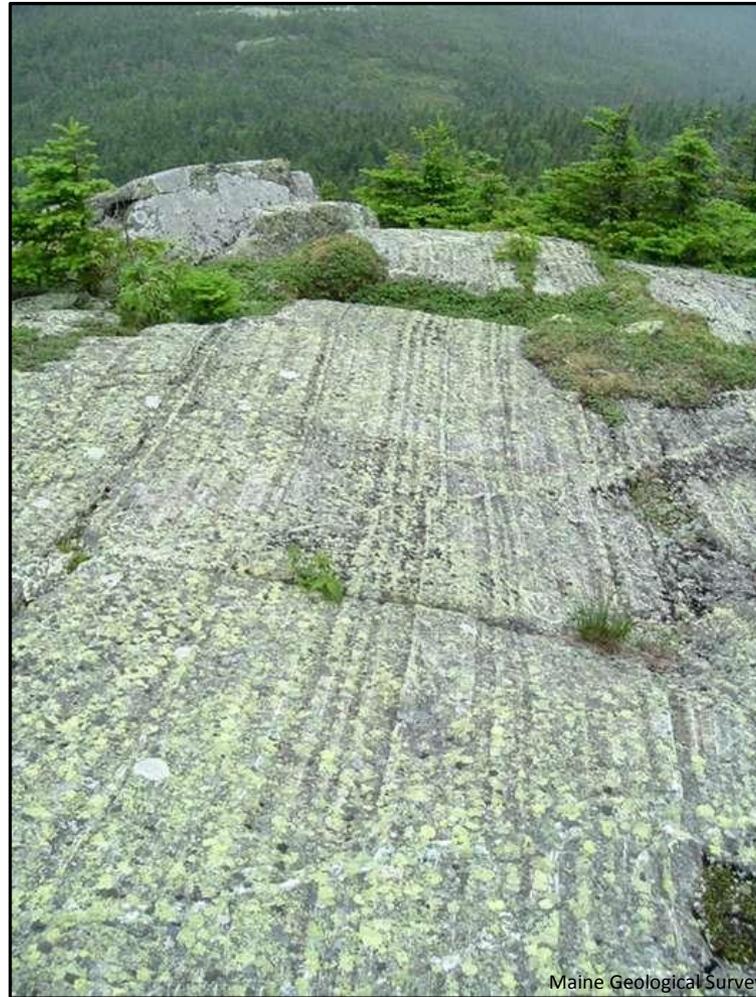


Photo by Robert A. Johnston

Figure 9. Bedding visible in an outcrop of the Rangeley metashale and metasandstone between the summits of Saddleback and The Horns.

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