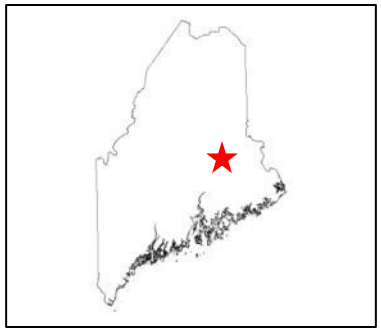
Geologic Site of the Month

September, 2006

Gordon Falls on the Mattawamkeag River: Red Rocks and White Water



45 30‘ 14.22“ N, 68 18‘ 6.07“ W

Text by
Marc Loiselle

Introduction

Upper and Lower Gordon Falls on the Mattawamkeag River (Figure 1) in the towns of Mattawamkeag and Winn are an excellent locality to view several stretches of Maine whitewater rapids, examine water-worn potholes in the bedrock, scramble over structurally complex Silurian metasediments, and even get a lesson in the transport of glacial erratics .... and, at the right time of the year, take a dip in the Mattawamkeag River.

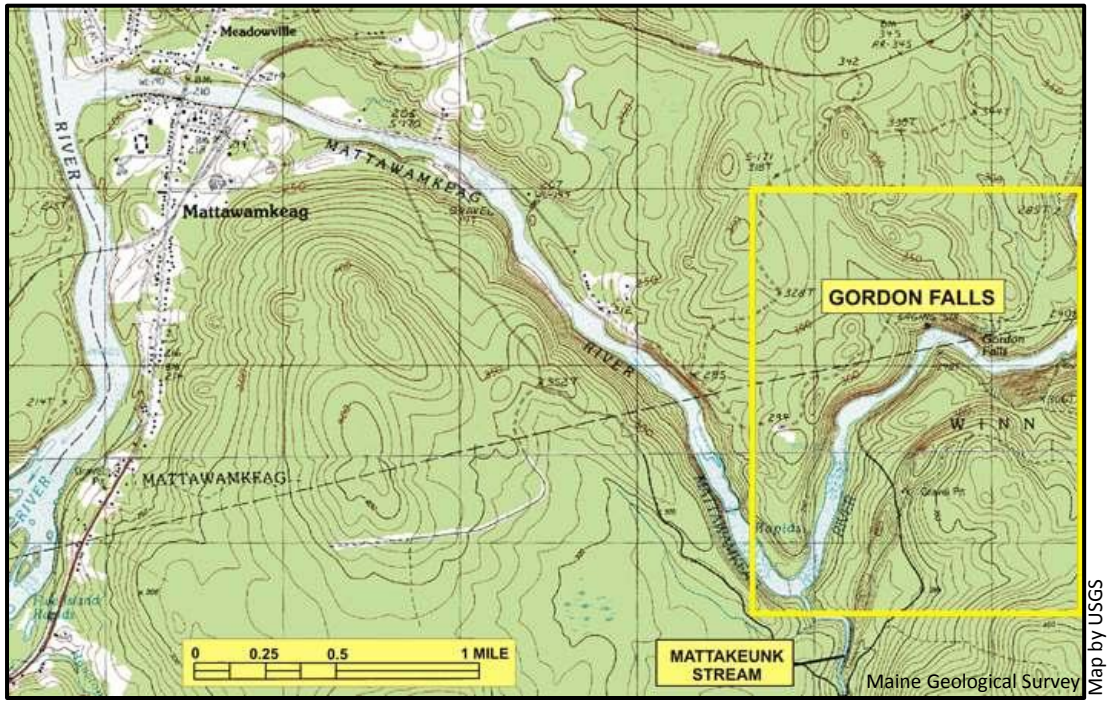


Figure 1. Regional topographic map showing location of Gordon Falls.

Location

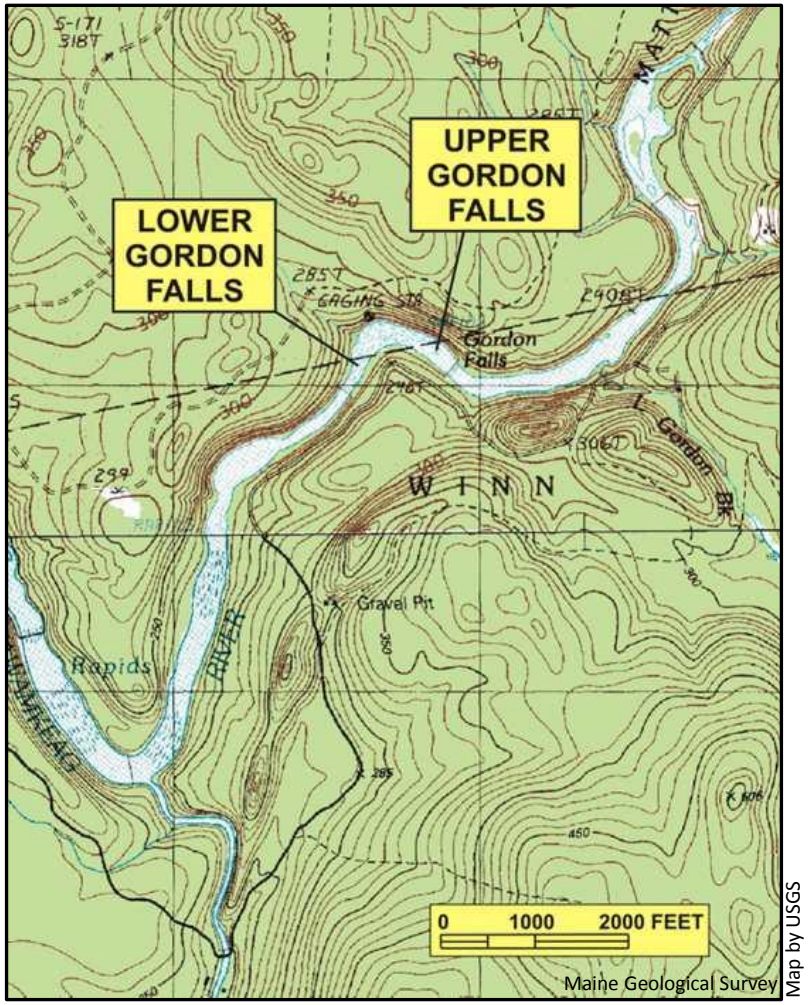


Figure 2. Regional topographic map inset from Figure 1.

Directions

Take Interstate 95 north from Bangor to Lincoln. In Lincoln, take Route 2 north to the town of Mattawamkeag. Look for the sign on the right leading to the Mattawamkeag Wilderness Park (Figure 3).

Figure 3. Sign pointing to the Mattawamkeag Wilderness Park. Mattawamkeag Wilderness Park is owned and run by the Town of Mattawamkeag, and has camping sites, RV hookups, full bath and shower facilities, and more.

Directions

Turn right here and check your odometer. Follow the road toward the Wilderness Park; at 3.4 miles from Route 2, watch for and cautiously cross the bridge (Figure 4) over Mattakeunk Stream.

Figure 4. Bridge over Mattakeunk Stream

Directions

Continue to Lower Gordon Falls at 4.9 miles. Upper Gordon Falls is 0.1 mile further up the road - easy walking distance from the Lower Falls.

Photos by M. Loiselle

Figure 5. Signs at the falls

Mattawamkeag River

The Mattawamkeag River is the longest river in Maine with effectively no regulation of its flow by dams. The river drains slightly over 1500 square miles, and the large basin size and high percentage of wetlands in the basin provides moderate flows even throughout the summer months. The U.S. Geological Survey maintains a stream gauge just below Lower Gordon Falls.

Figure 6. Looking upstream along Upper Gordon Falls.

Mattawamkeag River

The hydrograph (Figure 7) shows that a very wet fall in 2005 and warm and wet winter in 2006 kept stream flows well above the median values until April of 2006, when a dry spring and minimal snowpack produced a lower than normal freshet. The flows when the high-water and low-water photographs below were taken are indicated on the figure.

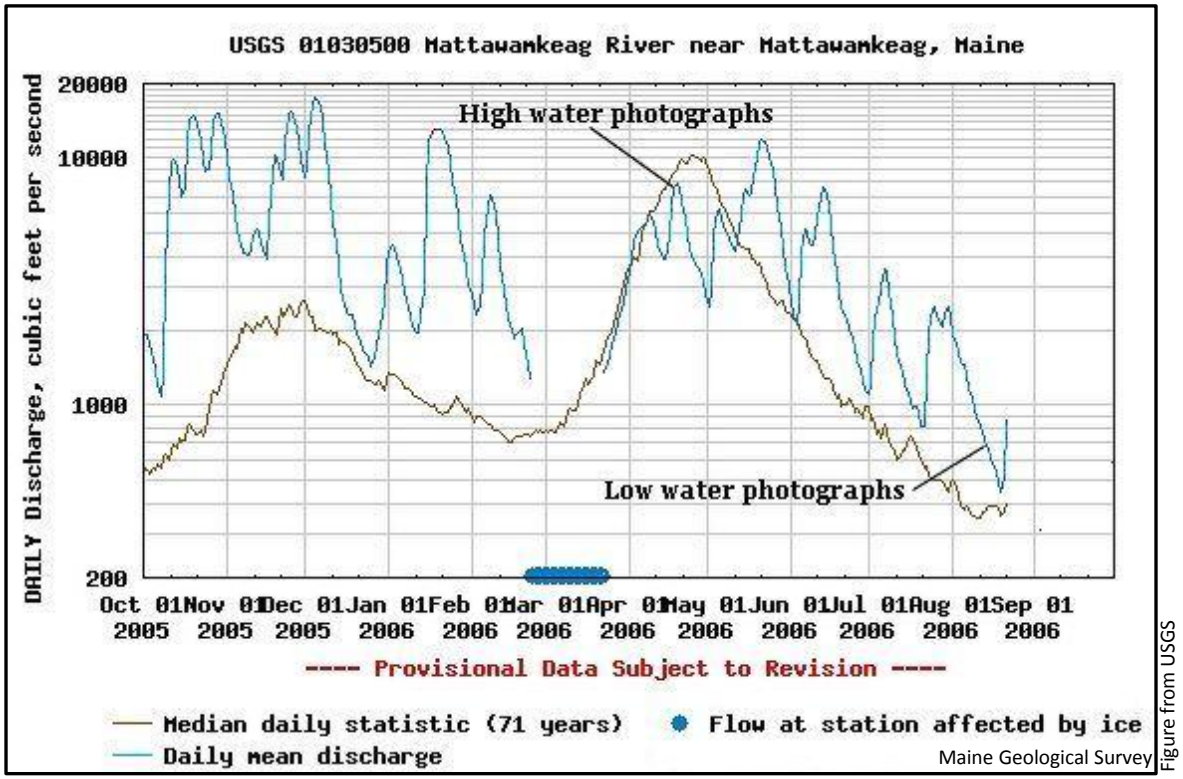


Figure from USGS

Figure 7. Hydrograph of stream flow from October 2005 through late August 2006. Daily mean discharge measured for the period (blue line) is compared to the median daily discharge based on 71 years of flow data (brown line).

Mattawamkeag River

By statute, the Mattawamkeag River from the Kingman-Mattawamkeag boundary to its confluence with the Penobscot River is defined as a Class AA river, the highest water quality classification for a river in Maine [MSRS Title 38, sec. 467, 7,D,(1),(b)]. (See the Maine Department of Environmental Protection's Classification of Maine Waters for a description of Maine's water quality classifications.)

The stretch of the Mattawamkeag River from Kingman to Mattawamkeag is rated as Class II-IV for canoeists and kayakers. The most difficult stretch is through Slewgundy Heater upstream from Gordon Falls. This stretch of river through Slewgundy Heater is not as accessible as Gordon Falls, however, and does not provide as much access to the rocks. Descriptions of runs through this section of the river can be read at the American Whitewater Mattawamkeag webpage.

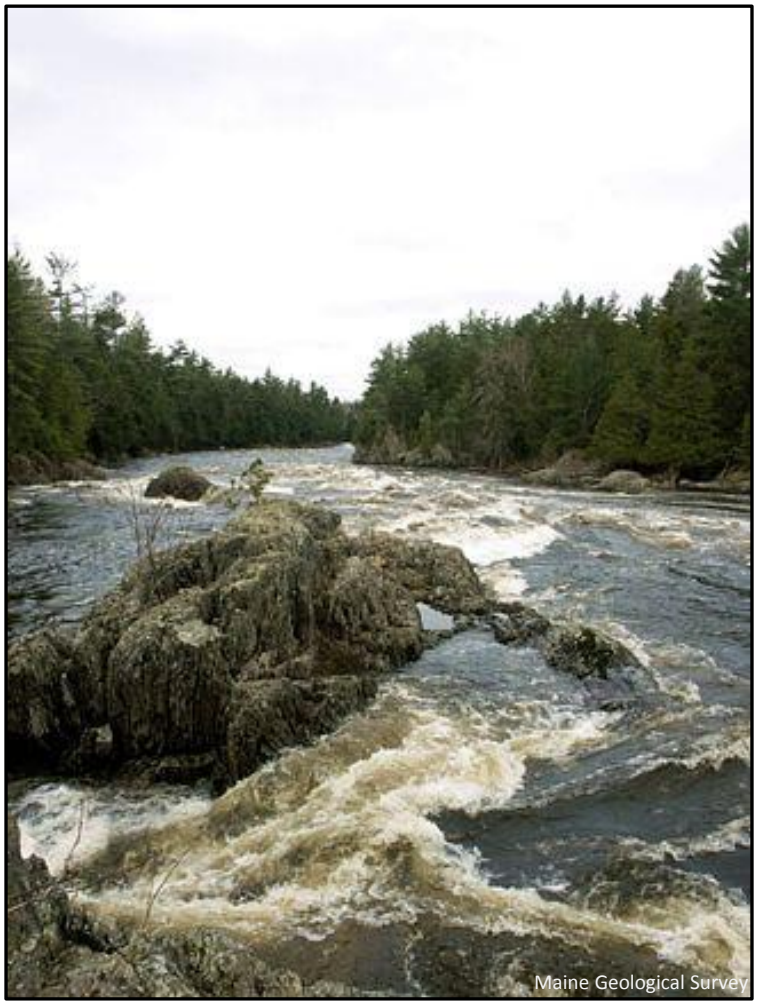
Gordon Falls

These photo pairs taken from approximately the same location show the Falls in April during high-water conditions and in early August during low-water conditions.

Photos by M. Loiselle

Figure 8. High-water (Left) and low-water (Right) pair at Upper Gordon Falls.

Gordon Falls



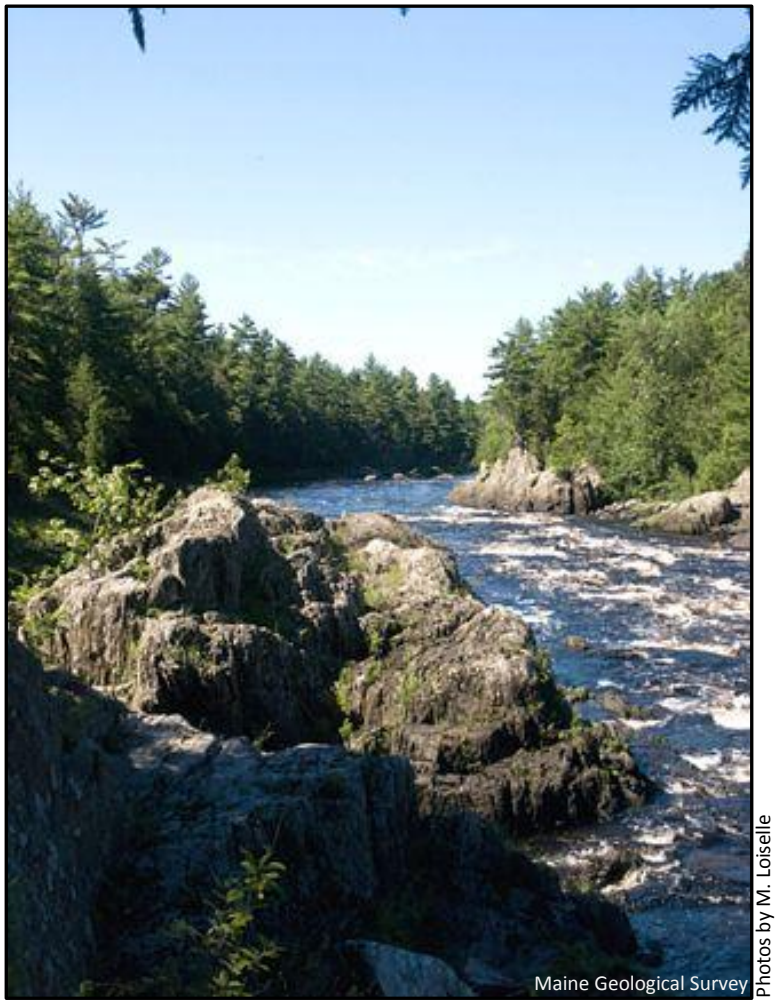


Figure 9. High-water (Left) and low-water (Right) pair at Lower Gordon Falls.

Bedrock at Gordon Falls

The Mattawamkeag drainage basin is underlain primarily by Ordovician and Silurian metamorphosed sedimentary rocks of the Kearsarge-Central Maine synclinorium. On the 1985 Bedrock Geologic Map of Maine (Osberg and others, 1985), the rocks at Gordon Falls are described as "Silurian undifferentiated pelites and sandstones," but subsequent work suggests a correlation with the Silurian Smyrna Mills Formation to the north (Hopeck, 1991; Ludman and others, 1993).

The metamorphic grade is low - greenschist grade and lower - and the combination of the pelitic nature of the rock and low metamorphic grade explains the low topographic relief and high percentage of wetlands in the basin.

Bedrock at Gordon Falls

The bulk of the exposed bedrock at Gordon Falls are green to gray pelites with a pronounced slaty cleavage (Figure 10).

Figure 10. Dominant pelitic rocks at Lower Gordon Falls showing a pronounced slaty cleavage.

Bedrock at Gordon Falls

However, at low water, benches of bedrock at the lower end of Upper Gordon Falls reveal reddish beds (Figure 11) much richer in iron and manganese than the bulk of the formation. To the north, manganese deposits in the Silurian Maple Mountain Formation (Pavlides, 1962) (correlated with Smyrna Mills Formation and the undifferentiated pelitic rocks at Gordon Falls) may have been deposited in a similar sedimentary environment.

Figure 11. Iron-rich pelitic rocks at the lower end of Upper Gordon Falls.

Bedrock at Gordon Falls

The rocks are strongly foliated (layered) in a N35E direction with near vertical dips. This foliation is sub-parallel to the primary bedding in the rock. At Lower Gordon Falls, the river is parallel to the foliation and bedding (Figure 12).

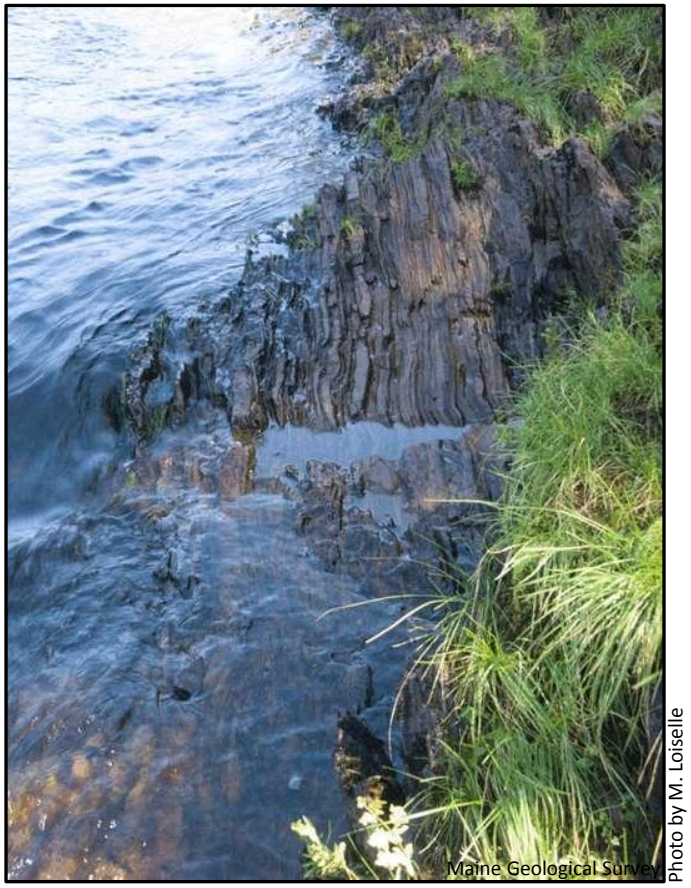


Figure 12. Foliation and bedding are parallel to the Mattawamkeag River at Lower Gordon Falls.

Bedrock at Gordon Falls

At Upper Gordon Falls, the river runs across the strike of the foliation (Figure 13). The 90-degree bend in the river at Gordon Falls is most likely due to the river following a late, northwest trending fracture orientation. Abundant quartz veins, shearing, and truncated foliation and compositional layering at Upper Gordon Falls support this idea.

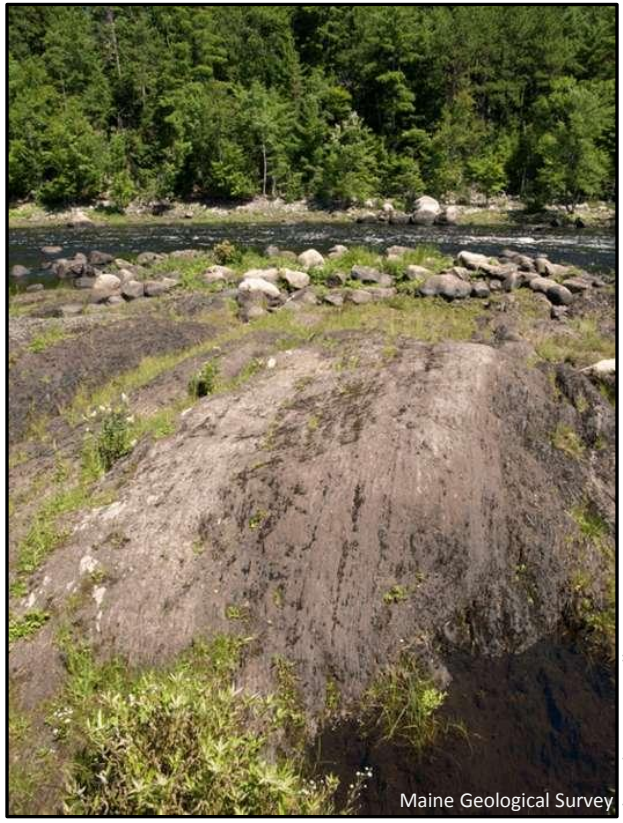


Figure 13. Foliation in the bedrock at Upper Gordon Falls is at right-angles to the course of the river.

Potholes

At Lower Gordon Falls, the orientation of the foliation parallel to the river is very favorable to the formation of potholes in the bedrock, caused by erosion produced by sediment trapped in eddies abrading the bedrock. Potholes (Figure 14) are common at low water at Lower Gordon Falls, but absent at Upper Gordon Falls.

Photos by M. Loiselle

Figure 14. Potholes in the bedrock at Lower Gordon Falls. The sediment that grinds out the pothole during periods of high flow can be seen in the bottom of some of the pothole.

Upper Gordon Falls

Upper Gordon Falls is more difficult for canoeists and kayakers to navigate because the river steps down across the bedrock ledges (Figure 15).

Figure 15. Upper Gordon Falls at high water, showing the stair-step effect produced by the orientation of the river relative to the foliation.

Upper Gordon Falls

The orientation of foliation at right angles to the river provides much more bedrock exposure at the upper falls (Figure 16).

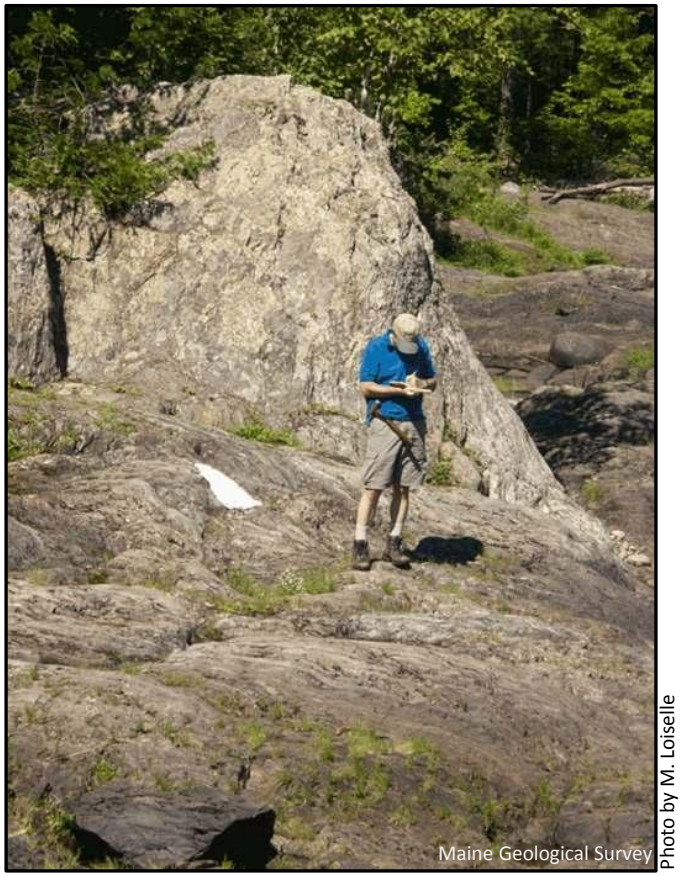


Figure 16. Dr. Henry Berry of the Maine Geological Survey makes notes on the lithology and structure of the rocks.

Upper Gordon Falls

The broader benches exposed at Upper Gordon Falls show some of the complex folding present in the rock (Figure 17 and Figure 18).

Figure 17. Folding at Upper Gordon Falls. Broader, more open folds are visible in the contacts between the light and dark compositional layering; tighter folds can be seen in the thin laminae in the light band. Axial planes are generally parallel to the foliation, with steeply dipping fold axes.

Upper Gordon Falls

Figure 18. Z-folds in pelitic bedrock at Upper Gordon Falls.

Glacial Erratics

As you walk around the falls, look at the many loose boulders ranging in size from basketballs to small cars. You should notice that there are very few boulders of the local bedrock - it is far too foliated and weak to take much transport and the associated grinding by glacial ice. In fact, the vast majority of boulders are Katahdin granite (Figure 19). The Katahdin batholith, the source for most of the boulders, is about 30 miles northwest of the Falls.

Figure 19. Large glacial erratic of Katahdin granite at Lower Gordon Falls.

References and Additional Information

Hopeck, John T., 1991, Faulting and related fabrics in the Miramichi and Aroostook - Matapedia tracts, Maine, in Ludman, Allan (editor), Geology of the coastal lithotectonic block and neighboring terranes, eastern Maine and southern New Brunswick: New England Intercollegiate Geological Conference, 83rd Annual Meeting, September 27-29, 1991, Princeton, Maine, p. 294-308.

Ludman, Allan, Hopeck, John T., and Brock, Pamela Chase, 1993, Nature of the Acadian orogeny in eastern Maine, in Roy, David C., and Skehan, James W. (editors), The Acadian orogeny; recent studies in New England, Maritime Canada, and the autochthonous foreland: Geological Society of America, Special Paper 275, p. 67-84.

Osberg, Phillip H., Hussey, Arthur M., II and Boone, Gary (editors), 1985, Bedrock geologic map of Maine: Maine Geological Survey (Department of Conservation), scale 1:500,000.

Pavlides, Louis, 1962, Geology and manganese deposits of the Maple and Hovey Mountains area, Aroostook County, Maine: U. S. Geological Survey, Professional Paper 362, 116 p.