Trip A-4

WORKING ACROSS THE DISCIPLINES: BIOLOGY, ART, AND GEOLOGY MEET AT THE ADIRONDACK HIGHLAND-LOWLAND BOUNDARY

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The purpose of this field trip is to explore the kinds of interactions the biologist, artist, and geologist can bring to bear on a location geologists might tend to think of as "their own." We have selected Stone Valley in Colton New York as a place where an interdisciplinary approach to the locality is particularly fruitful. Too often, the geologist's eye is so fixed on the bedrock or the geomorphology of an area that he or she scarcely notices the animals and plants of the area. Although we all probably recognize the importance of being able to sketch the landscape, geological, and biological features of places as a way of recording what we see, we rarely sit down really to devote full attention to recording in sketches the esthetic dimensions of field sites. Drawing is also a fantastic tool for seeing. The act of drawing forces us to look more carefully at the scene we are observing.

NOTE: PLEASE BRING A DRAWING PAD OR NOTEBOOK AND DRAWING PENCILS. YOU MAY WANT TO BRING ALONG A FEW COLORED PENCILS AS WELL.

THE LOCATION

Stone Valley is located along the Raquette River, north of the village of Colton, NY. The area is in the center of the Colton 7.5-minute. The instructions below indicate how to reach the meeting point for this field trip:

0	SUNY Potsdam Main Entrance along Route 56S (also known as Pierrepont Avenue). Drive south on Route 56S.
2.6	Note gravel pits to the left (east) filled in with water.
3.8	Note bridge over Raquette River with a Dam to the right (village of Hannawa Falls). For those interested, there is a newly laid foot trail to an old Potsdam Sandstone quarry. If you take a right directly after this bridge and park near the new sign there is a nice walk along river which ends at the quarry.
8.4	Adirondack Highland granitic gneiss crops out on the right (west) below the school.
8.5	Turn left onto Main Street in the village of Colton). Note the Hepburn Library on the right after you turn; it is made of blocks of Precambrian Gneiss. On the left, across the road from this is the Episcopal church, made of Potsdam Sandstone. Meet Bill, Lucretia, and Bill, the trip leaders, on Main Street at these buildings. We will then lead you on to the first stop.

We will walk down Stone Valley on either the west or east bank of the Raquette River, depending on conditions. This guide describes the trail along the west bank, but outcrop descriptions apply to both trails. Before going down the trail, however, we will begin by doing some sketching to limber up our artistic muscles. We will lead you to a suitably picturesque location for beginning a first sketch.

SKETCHING AS A MEANS OF SEEING: NOTES FROM LUCRETIA

Drawing is training your eyes to really *see* a landscape or object, and to observe the relationship of one item to another. To begin with I use a 5.5 inch by 8.5 inch Strathmore 100-sheet sketchbook. In the comb binding I put a pilot-brand precise extra-fine pen. I keep the sketchbook shut with a rubber band. It fits neatly in my pocket. If you want to be fancy you can add some colored pencils to your pocket.

Starting:

Why did you look at this landscape or rock in the first place? Pick an image that interests you. If we are beside a stream, a good place to start would be the "horizon" of that stream. Your pen should "walk" slowly along the edge of the stream. The next line would be rocks or ripples" *connected* to the first line. Do not make scratch marks all over the paper, but build upon that first line.

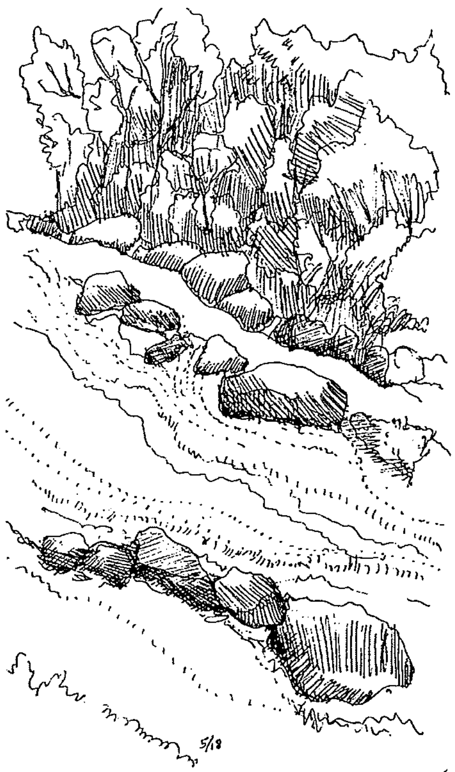
A tree limb has two sides. Draw the first. Then add the second. For a tree in full leaf, draw an outline of the foliage. Then later you can add some cross-hatching to indicate the darker, denser areas.

Remember that you are creating an image and not taking a photograph. This is *your* picture. Since you cannot draw everything in a landscape you will have to choose the part that is most important to you and build on that. A rock in the middle of the stream probably has other rocks *behind* it. Of these second and other rocks, you will probably see only parts of them. You will see only part of the more distant objects, as well.

In a landscape, the closer mountain or other feature would be drawn first and more distant landforms would be added later. In a stream, if you see a fish, think, "What makes it a 'fish shape'?" Draw the barest outline and later you could add fins, mouth, etc. A bird settles on the sand. How could you indicate it is a bird and not a boulder? Well, it probably has a tail and a beak. Rocks usually do not. If it rains, the water will speckle the ink lines on the paper, and you will always know when looking at the drawing that it rained that day.

After Lucretia does a 10-minute demonstration of some sketching techniques, we will all spend some time together doing some initial sketching. Lucretia will circulate among the group to provide help as needed, and Bill, Lucretia, and Bill will lead a discussion of some of the biological and geological aspects we and you see in them.

Later, when we head down into Stone Valley, we encourage you to sit down and do some more sketching on your own. When we return to the cars at the end of the trip, Lucretia will be waiting to discuss your sketches with you, and we can all share our ideas about them and the connections we've found among the geological, biological, and esthetic aspects of the excursion.



Two sketches
Lucretia did in Stone Valley last spring.

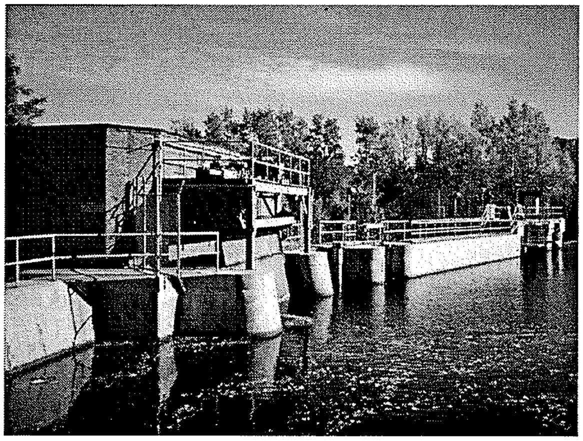
EXPLORING STONE VALLEY

The Raquette River flows north from the Adirondack Highlands from Tupper Lake. It is the most dammed river in the Adirondacks, with 8 major dams. South of Colton it flows through Potsdam, Norwood, Norfolk, and passes just south of Massena before flowing into the St. Lawrence River at St. Regis Village. The reservoir behind the dam at Colton extends some 6 km south to the next dam up the line, at South Colton.

The West Side of the Valley

We begin our descent to Stone Valley along the gravel road leading north from the parking lot on River Road. We will first see the power plant at the dam. It is one of several such plants such as the ones at Hannawa Falls and Norfolk. The photos below show the dam at Colton (left) and the penstock that leads water from the Colton reservoir 5 km south to the power plant just south of Brown's Bridge. This generating plant produces 30 megawatts of power and is one of 8 generation stations on the upper Raquette River that produce a total of approximately 100 megawatts of power (owned by Reliant Energy).

Cross over the penstock via a small brown-painted metal foot-bridge onto the main path which then follows the river downstream past some spectacular falls. A short distance down the trail is the stone foundation of a tanner's mill. During the expansion to the western states, bison pelts were shipped east by rail and tanned wherever tanners could find the raw materials for the tannin, such as in the Adirondacks. Huge piles of bison fur accumulated outside tanneries such as this and remain today (hair is not easily degraded by microorganisms). Right past the foundation there is a 15 foot section of trail where the "buffalo fur mountain" can be seen underfoot. The ground sounds hollow here when you stamp on it. A look at the ground reveals clumps of matted buffalo fur that remain here to this day.



The dam and penstock at Colton

The gorge of the Raquette River as it tumbles down Stone Valley from below the dam at Colton is steep, narrow, and scenic. Vast numbers of logs were floated down the north-flowing Adirondack rivers to the St. Lawrence. Many towns were established along the "fall line," the escarpment where the hard Precambrian rocks of the Adirondacks are in contact with the flat-lying Lower Paleozoic sedimentary rocks of the St. Lawrence Valley. This contact is marked by relatively sharp topographic drops between the harder metamorphic rocks to the south and the flat-lying sediments to the north. The crystalline rocks form steps over which the river tumbles in waterfalls that provided hydropower to operate saws and other equipment. The falls at Colton represent such a place. In these days of extreme sports kayak races are now popular, as daring boatmen test themselves through the roaring falls in times of high water.

A caution: Depending on the water level (which in turn depends on the time of year and the amount of water being released at the dam), various platforms of bedrock can be visited along the river. Signs warn of the possibility of being caught by rapidly rising water levels, but the power company provides no advance warning. The excellent hiking trails along both sides of the river make it possible to examine many of the excellent bedrock exposures.

Once down along Stone Valley we will assemble on one or another set of stream-polished outcrops of rocks of the Carthage-Colton mylonite zone, the boundary zone between the Adirondack Highlands and Northwest Adirondack Lowlands. First we will look around at the gneisses and the general topography and geomorphology of the area, with commentary from Bill D. ("older Bill"). Then we will explore the area for its biological dimensions with Bill L. ("tall Bill"). We invite you to do some sketching so that you will have things to show to Lucretia when we return to the cars and things to discuss on the outcrops as well. Throughout, the group leaders will interact with each other and with the trip participants to consider the connections among the geological, biological, and artistic attractions of the area. What can the geologist, biologist, and artist contribute to each other and take from each other in exploring an area such as Stone Valley? What kinds of new insights can emerge from cross-disciplinary action and an earth-systems approach to an area?

THE BIOLOGICAL SETTING

Local people take favorite short hikes in the beautiful deciduous forest surrounding the falls. The energy companies have worked with the communities to make this land accessible to the public. This is an interesting case of how development has led to "preservation," or at least continued public access to spectacular river frontage that might otherwise have gone to private owners who could have blocked access. A broad variety of mosses and ferns exist along the river. In the outcrops in the river are pools that come in a variety of sizes. Some of these are the result of glacial scouring while others are potholes formed by the erosive action of pebbles. The photo below shows some pebbles in a pothole.

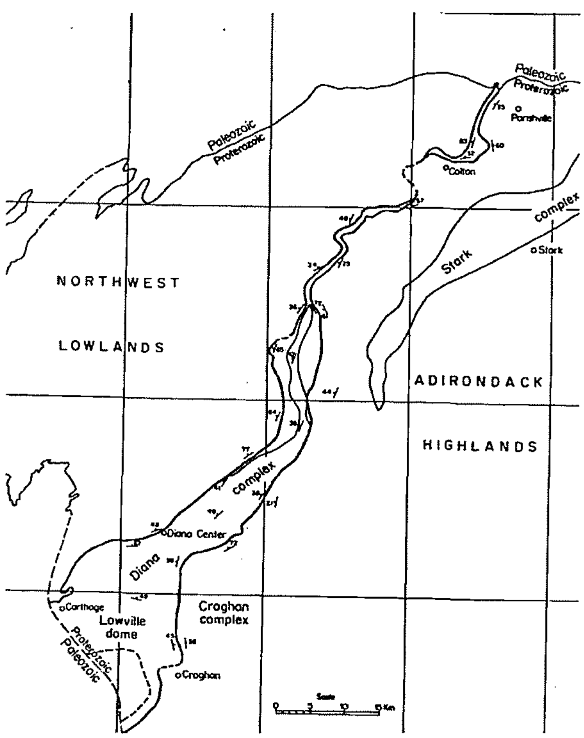
Like the tide pools in a rocky intertidal zone along the ocean, these pools create mini-ecosystems with algae growing in them that feed crayfish, trapped minnows, and a variety of insects including the larvae of dragonflies, mayflies, and black flies. Other insects such as water striders and riffle bugs colonize the surface of these pools. The exoskeletons shed by some of these insects can be seen along the sides of pools. In early spring these pools are full of frog tadpoles and the larvae of salamanders. It is not clear what species of fish exist in the main channel of the river, though the damming and water fluctuation may severely impact them.

From a biological perspective, the rocks define boundaries such as rock pools where the animals live and they provide the channel leading to high water velocities which limit the types of organisms that live there. The scouring of the bedrock along the edge of the river by the high waters in the spring and the ice in the winter creates a yearly disturbance which makes it difficult for animals to hold a territory or home for long. The main types of animals that can live along and in the river are opportunistic animals that reproduce quickly during the summer.

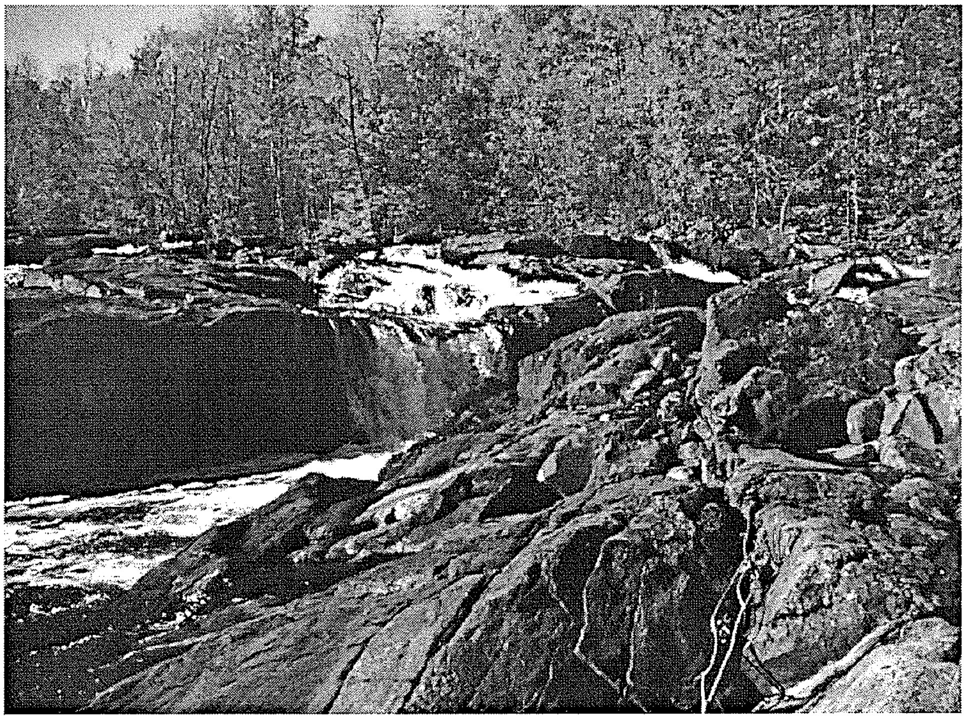
As a biologist looking at the geology, one could see the physical geology (rock and water) as a starting point to which the animals have adapted over the years (evolution of certain adaptations), as well as the environment that an individual deals with in the short term. The outcrops and naturally changing water flow provide a harsh environment for most aquatic organisms, but one to which many animals and plants have evolved adaptations. However, the recent changes due to damming and random fluctuations in water level to suit the needs of power generation have probably severely impacted the aquatic life here. As in any system that is dammed (the Grand Canyon and Green River have received much attention recently), there are a variety of impacts to the aquatic organisms. Dams reduce the amount of silt deposited downstream, and cause it to settle upstream Too much silt blankets organisms; too little reduces the nutrients available. This severely reduces the types of aquatic insects that can live in such a stream, with repercussions up the food chain to the top predators such as fish and birds. Additionally, the constant changing of water levels in a non-seasonal pattern leads to a separation between the aquatic and terrestrial ecosystems. Recent research (summarized in Allan 1997) shows the importance of stream banks to the lives of most aquatic organisms. For example, fish need undercut banks to hide in and to lay eggs and many aquatic invertebrates, especially the herbivorous "shredders", need the input of leaves and wood from the surrounding forests to eat. Dams lead to the disturbance of these all-important riparian zones.

Power dams also tend to leave the water colder and with less oxygen, which impacts which fish and insects can live in an area. Perhaps more important, but more subtle, is that the water levels in the river below a power dam don't fluctuate in the predictable yearly pattern to which organisms have adapted. Instead, they fluctuate due to consumer demand and market forces. This can lead to problems for developing fish eggs or the development and emergence cues for aquatic insects (Allan, 1997). So, despite the beauty of the area, and its value as a recreation area (swimming, kayaking, hiking), the anthropogenic disturbances caused by the dam have probably led to a decrease in diversity of organisms and perhaps a decrease in abundance of top predators such as fish. Little work has been done on the biological health of this particular area, but one would predict that a more steady release of water that mimics the natural yearly fluctuations would increase the diversity and abundance of organisms in the area.

THE GEOLOGIC SETTING

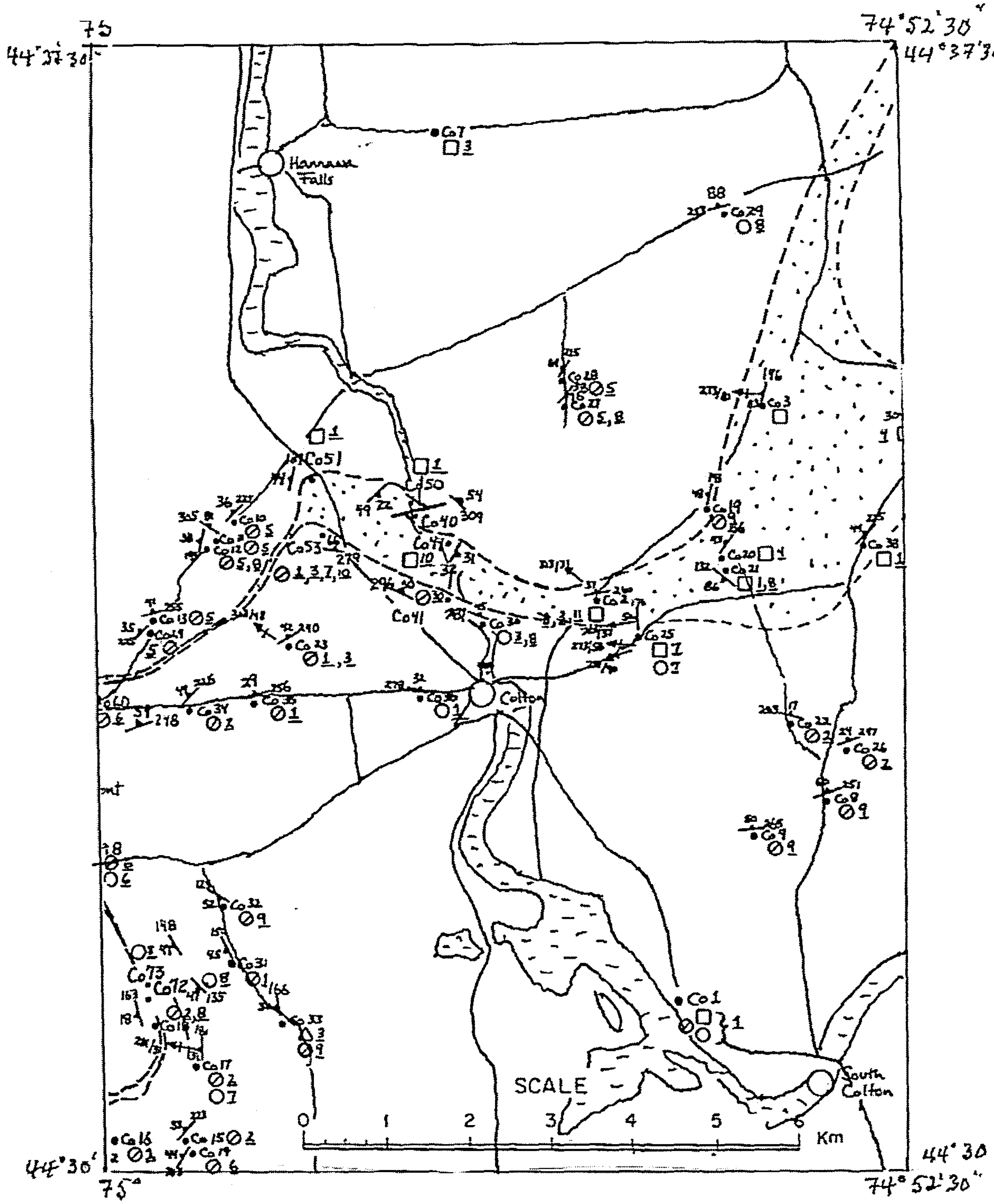


Colton is located near the northeast end of the Carthage-Colton mylonite zone, which separates the high-grade Precambrian (Grenvillian) metamorphic rocks of the Adirondack Highlands to the south and east from the lower grade Precambrian metamorphic rocks underlying the Northwest Adirondack Lowlands to the north and west. This zone begins near Carthage, NY where the Paleozoic sedimentary rocks southwest of Carthage cover the Precambrian rocks of the Adirondack. It extends almost continuously some 110 km northeastward to the point where Paleozoic rocks of the St. Lawrence Lowlands again cover the Adirondack rocks at Allen's Falls, just east of Potsdam. The zone is not exposed over a distance of a few km just southwest of Colton where it is apparently covered by Quaternary materials. This zone of highly deformed, sheared rocks separating the rocks of the Adirondack Highlands from those of the Adirondack Lowlands has been described in detail by Geraghty and others (1981). See their map (above left). This zone ranges in width from a few feet just southwest of Colton to as much as 5 km in the area between Croghan and Carthage. Quartzo-feldspathic gneiss, rocks of the anorthosite suite, and some clearly metasedimentary rocks (marble, quartzite) form the rugged terrain of the Adirondack Higlands. The northwest Adirondack Lowlands are relatively flat and include more abundant clearly metasedimentary rocks than do the highlands.



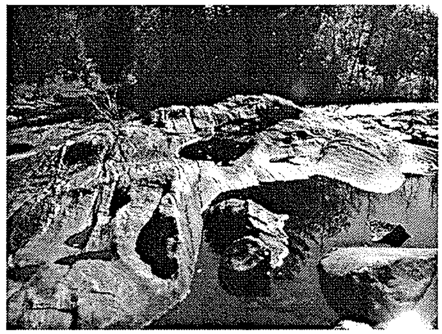
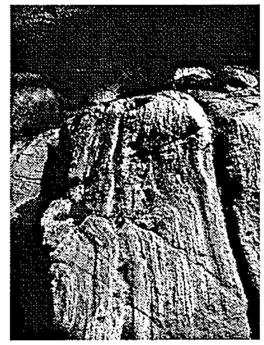
As we descend along Stone Valley, in addition to seeing the dramatic topography and geomorphology of the valley, mentioned above, many fine exposures of Grenvillian Precambrian rocks crop out in the gorge. See photo, left.

The map on the following page, modified slightly from Geraghty and others (1981), shows some details of the geology of the Carthage-Colton-zone rocks in the Colton Quadrangle. The strike and dip symbols show the orientation of foliation in the gneisses, which are mainly quartzo-feldspathic and amphibolitic in Stone Valley. Numbers refer to rock types. See Geraghty and others, 1981, for details. Colton is located in the center of the map, just south of the Carthage-Colton Zone, on the Adirondack Highland side of the mylonite zone. The Colton dam is indicated by the heavy, dark line across the river just north of the circle representing the center of Colton. The outcrops just below the dam are of Highland granitic gneiss. Those in the stippled area are of highly sheared gneiss. Those north of the stippled area belong to the Adirondack Lowland group. South Colton is in the lower right of the map, and Hannawa Falls is in the upper left corner. The mylonite zone is stippled, and the Raquette River is indicated by short dashes.

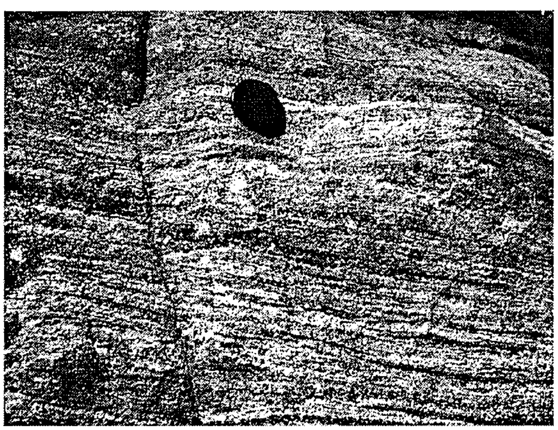


Geology from Geraghty and others (1981), with addition of road network and river.

The outcrops along Stone Valley are of various kinds of quartzo-feldspathic gneiss. They have been sculpted, smoothed, and polished by the glaciers that covered this area during the last glaciation, which ended in this area something over 10,000 years ago. In the photo, below left, the glaciated rocks of the stream bed can be seen to be well foliated as well. Closer views of this metamorphic foliation can be seen in the photos below at the center and at the right.

As shown in the photo at the left, below, a distinct, streaky foliation of alternating layers of quartzo-feldspathic and mafic layers can be seen in many outcrops. Discontinuous layering ranges in thickness from a couple of millimeters to a couple of centimeters. A typical pegmatite dike appears in the photo at the right, below. What significant metamorphic minerals can we find in these outcrops? Garnets




The photo below (left) shows small isoclinal folds in the foliation of streaky quartzo-feldspathic gneiss seen on the rocky platform shown in the photo at the upper right, below. The photo at the lower right shows well-developed foliation in mylonitic gneiss.

Much of the surface area of the outcrops in the stream has been glacially polished, although river action has further eroded the surface. Note many river-formed potholes in addition to glacial grooving. The top surface of the rocks retains polish in some areas. In others, it has been eroded off. A thin, partially exfoliated surface can be seen on many outcrops.

Acknowledgements: Thanks to Lou-Anne Conroy for sharing her ideas and masters thesis on the effects of dams on macroinvertebrates. Thanks also to Robert Badger for organizing this volume.

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