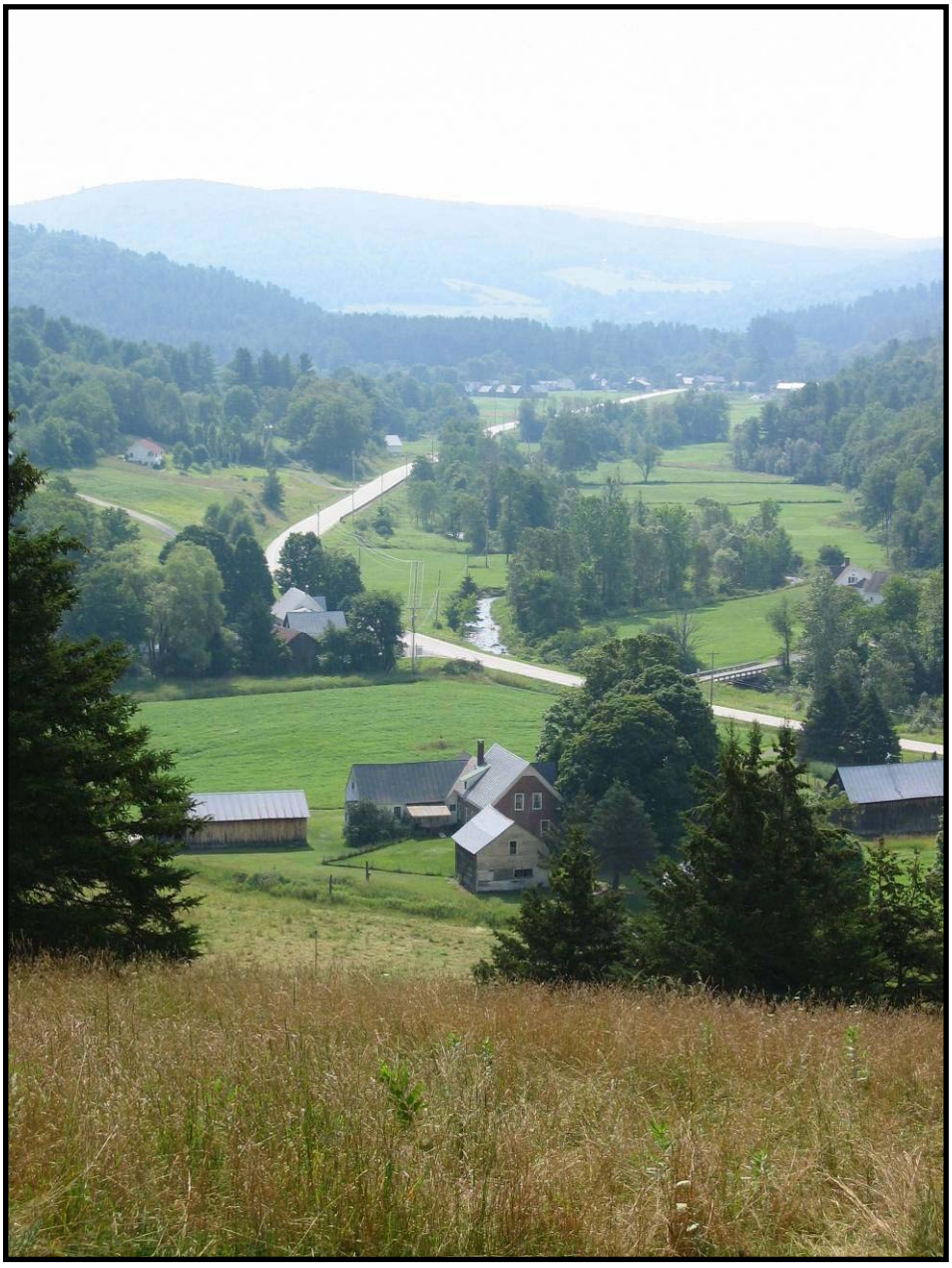
THE PROSPER VALLEY VIGNETTES

- A natural and cultural history of the watershed connecting the Vermont towns of Barnard, Bridgewater, Pomfret and Woodstock –

By Corrie Miller, Winter 2006/07



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THE PROSPER VALLEY VIGNETTES:

At Home in the Valley – An Introduction

My love affair with this valley began with a herd of cattle. I had just gotten a job in Woodstock and was driving along Route 12 to look at an apartment in Barnard. At the urging of a flashing yellow light, I slowed my car to a stop in front of a line of cows crossing the road. At the time, I didn't know that I would take the apartment and travel this corridor every day for a year, eventually becoming familiar with every turn in the river and every slope on the surrounding hills. I also didn't know that I would return to this valley three years later to do my master's research, this time leaving my car behind and donning a pair of hiking boots to explore the same stream and hills in greater depth. In that moment as I watched the cows cross the road, I only knew that the valley already felt like home.

Gulf Road Cut (left). Barnard, VT. Cut walls of bedrock mark the entrance into the Prosper Valley on Route 12. Photo courtesy of NPS.

Gulf Brook Headwaters (right). Barnard, VT. Water drains the surrounding highlands and converges in this cascading stream in the Barnard Gulf, establishing the Gulf Brook.

Each morning on my drive south to Woodstock, I crested the hill near the Barnard Gulf and coasted down the steep grade into the basin I now know as the Prosper Valley. Driving past the cut walls of bedrock exposed by past road crews, moose crossing signs,

Valley Farmland. Pomfret, VT. View northward along Route 12 at Lewis Farm and associated cow crossing. Photo courtesy of NPS.

Parallel Corridors. Woodstock, VT. Route 12 parallels the Gulf Brook from Barnard to Woodstock. Photo courtesy of NPS.

A Broadening Stream. Woodstock, VT. After the Gulf Brook's union with the Barnard Brook, the stream travels a short distance before emptying into the Ottauquechee River.

and forests of red spruce trees, I began to piece together an understanding of this new landscape. At the bottom of the big hill, Route 12 joins Gulf Brook in an interweaving dance across forest and farmland until the stream empties into the Ottauquechee River near Billings Farm in Woodstock. Along the way, many feeder streams converge with the Gulf, draining their associated highlands and defining narrower east-west valleys. Progressing roughly nine miles on a gradual downhill towards Woodstock, the landscape changes; the rock cuts, moose crossing signs and red spruce are replaced by a widened valley, cow crossing signs, and fields of wildflowers. Each day, I was awe-struck by the beauty of green fields against blue sky; by the way evening sunlight lit up the autumn foliage like wildfire; by the furry creatures that occasionally darted out in front of my car; and by the patches of uninterrupted forestland. That

first year, my love affair with the Valley was new and, like many new loves, it was based entirely on attraction. I left the region for other employment in 2004 and I'll admit that I became enamored with other places. But none had such a hold on my heart as the narrow valley connecting the four towns of Barnard, Bridgewater, Pomfret, and Woodstock.

When I returned to the Valley for the summer of 2006 I wanted more. I wanted to delve deeper—past the good looks—to begin really understanding the Valley. My purpose was to learn about its natural landscape and cultural history so I could share them with the local community in a celebration of their place. I traipsed through lowlands and highlands collecting knowledge of the landscapes pieces—tree species, rock types, animals, land uses… I took note of the way these pieces organize into patterns on the land—red spruce forests at the high elevations, black bears on the ridgelines… I racked my brain over the thousands of processes that could be responsible for the landscape patterns that I saw—climate, ancient continental collisions, ice storms, and land development… And then it happened—I started to make connections. I grasped how an ancient geological story explained the presence of some of the wildflowers I saw throughout the Valley and I understood how a more recent agricultural story explained many of the common forest types. I began to consider water the Valley's lifeblood and started thinking of the highlands and lowlands as an interconnected watershed, with each parcel of land connected to the others by the flow of water. All in all, I started to understand the whole system as the integration of three different landscapes—the physical landscape (bedrock and glacial geology), the natural landscape (soil, vegetation, and wildlife), and the cultural landscape (dealings of people through time).

This past summer of field work seasoned my relationship with the Prosper Valley—the black flies made sure it wasn't all sunshine and roses—but the feeling I am left with, after returning to my Burlington university life, is a deepened connection to that corner of the world. The Valley and I now have a shared history; I'll notice a smell in the wind that takes me back to the fields of wildflowers atop Dana Hill or I'll encounter dankness in the air that turns my thoughts to bygone investigations of Bridgewater

cellar holes. Now my task is simple—to share my stories of the Prosper Valley landscape with people who also consider it "home". It is my hope that these stories spark, rekindle, or stoke your love affair with this valley.

THE PROSPER VALLEY VIGNETTES:

The Story the Rocks Tell – Prosper Valley Bedrock Geology

People all over the world have personal connections to rocks—they collect them, carry them as "worry stones", adopt them as pets, and create altars from them. For most every individual, the sight or feel of a particular rock summons vivid memories and personal stories. For the landscape as a whole, rocks tell stories of the earth's past.

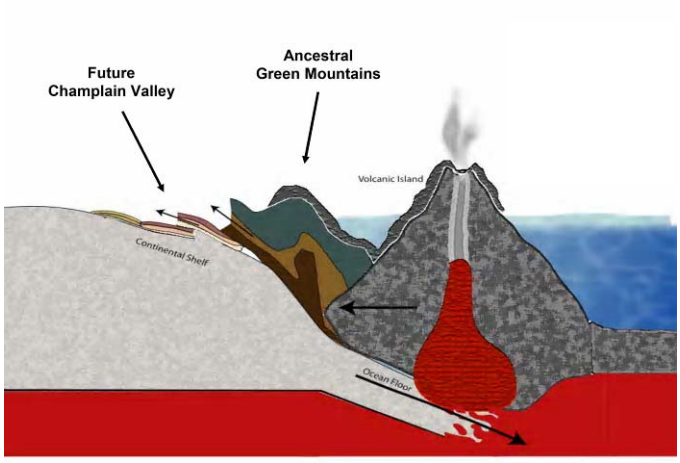
I uncovered one such story this summer in the Prosper Valley. I found rocks on hilltops and in creek beds; there were small jagged pebbles, large smooth boulders, and rocks with highways constructed through them. Some of the rocks had rough, pocked surfaces like they had been to Mars and back; others, when captured in a sunbeam, flashed thousands of small sparkles as if they held an entire night sky. This is the story these rocks tell.

"Martian-surface" Rock. Impure limestone or marble of the Waits River Formation; note pocked surface.

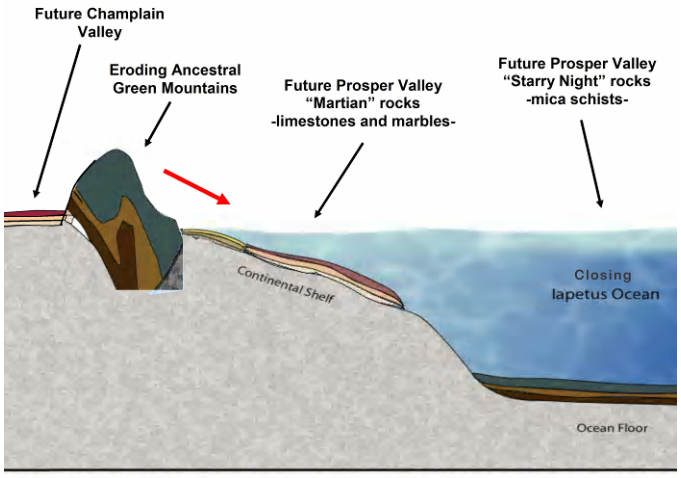
"Starry Night" Rock. Mica schist of Waits River Formation; note mica sparkles.

Once upon a time, the location that eventually became the Prosper Valley was beneath a vast tropical sea. Shelled creatures wafted about with the ebb and flow of tides and ocean currents while trilobites—ancestors of horseshoe crabs—scuttled across the floor of the continental shelf, where the sun infused the shallow water and supported primordial plant life. In the dark, deep ocean, out of the sun's reach, little life existed.

Geologists have named this ancient sea—a predecessor of the Atlantic Ocean—the Iapetus Ocean, after the titan Iapetus, father of Atlas.



Mountains are Born. ~450 million years ago, Taconic Orogeny. Collision of volcanic island arc with proto-North America; collision causes upheaval of oceanic sediments which form the ancestral Green Mountains. Image courtesy of Claire Dacey.



Sedimentation. ~450 - 400 million years ago. Sediments eroded from Ancestral Green Mountains and volcanic island arc are deposited into Iapetus Ocean; over time, these sediments become the rocks we see in the Prosper Valley today. Image courtesy of Claire Dacey and Corrie Miller.

Between 500 and 225 million years ago, the *continental plates*—giant shifting slabs of rock that move relative to one another above a hotter, deeper region—on both sides of this vast ocean moved on a collision course toward each other. An early impact between the primitive North American continent (*proto-North America*), to the west, and a volcanic island chain in the ocean carried enough force to uplift an entirely new mountain chain—that which today we call the Taconic and Green Mountains.

As the plates further converged, much of the island chain and newly uplifted Green Mountains—rising along the continent's eastern margin—was eroded into the contracting Iapetus Ocean. Some of these sediments reached the dark depths of the ocean while others settled on the shallow continental shelf. It is these sediments that were thrust up during subsequent collisions and now form the bedrock that we see in the Prosper

Valley. The contending plates hadn't, however, settled the score. Later collisions between proto-North America and various other landmasses forever closed the Iapetus Ocean and effectually fastened the land that is now New Hampshire and Maine onto North America.

Is it really possible that these stories are inscribed in a few rocks? One interpretation of the Prosper Valley's pocked, Martian-looking rocks is that they formed on the continental shelf of proto-North America from sediments eroded off the ancestral Green Mountains and volcanic island chain. Because they accumulated on the sunny continental shelf, these sediments were mixed with the remains of living organisms as they became rock. These rocks, therefore, have been a sort of storeroom of minerals from ancient organisms. The pocked surface results from the mineral calcite—derived from sea creatures' shells and algal mat secretions—dissolving more quickly than the other surrounding minerals. The areas on the rock's surface that were once calcite are now, after years of exposure to water, empty holes.

The sparkly Prosper Valley rocks, on the other hand, formed farther out in the Iapetus Ocean, beyond the reaches of sun-loving, calcium-secreting organisms. The sparkles emanating from the rocks are flecks of the mineral *mica*, which formed from clay minerals eroding off the young Green Mountains. Because of their small size, the clay particles traveled all the way into the ocean depths, past the continental shelf, before settling out in still water and becoming bottom sediments. Both of these ocean-lain sedimentary rocks, deposited on the continental shelf and in deep water, were thrust up and *metamorphosed*, or changed by pressure and heat, during the closure of the Iapetus. Consequently, they have a slightly different form today than upon first deposition.

The bedrock geology map of the area dubs the Prosper Valley bedrock the "Waits River formation" and describes my "Martian" rock as "impure limestone or marble weathering to a brown punky crust" and my "Starry Night" rock as "mica schist." The Waits River is a "formation" because these two rocks of different origins—one from the continental shelf, the other from deep water—exist together in jumbled layers,

presumably because they were shoved together during the plate collisions. This Valley is part of a large swath of the Waits River formation that runs the length of Vermont from Canada to Massachusetts, paralleling the ancient shoreline of the Iapetus. Immediately to the west of the Prosper Valley begins the wide belt of Green Mountain metamorphosed mudstones—similar in origin to my "Starry Night" rock, but with fewer impurities and greater degrees of metamorphism. To the region's east are the granites of New Hampshire that came from volcanic activity during the closing of the Iapetus.

In all these ways and more, geological events happening millions of years ago affect our experiences in the Prosper Valley today. The thought that the shell on the back of an ancient sea creature would end up in the rocks all around us is miraculous enough. But, the fact that this little shell, now in the form of calcite in the rock, causes the Prosper Valley soils to be significantly more fertile than those to the east or west is where it gets really interesting. This interaction between the Prosper Valley's bedrock and everything atop it is where the plot thickens, so to speak, and where my tale of the Prosper Valley landscape begins.

By Corrie Miller, Winter 2006/07

THE PROSPER VALLEY VIGNETTES:

Familiar Hills and Hollows – Prosper Valley Topography and Hydrology

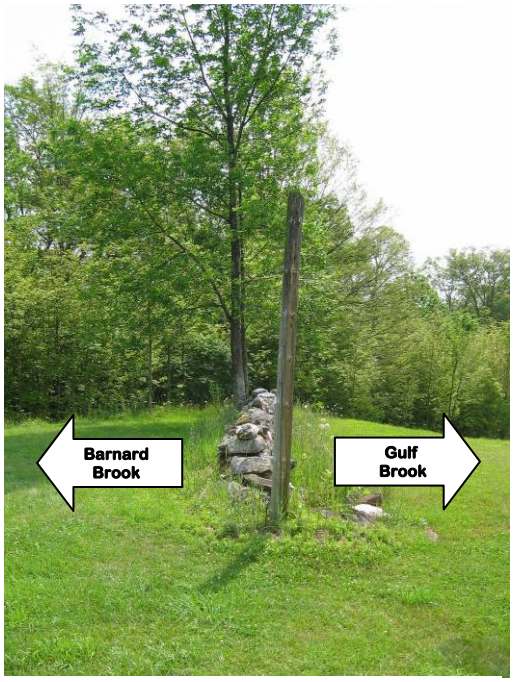
Distant Ridgelines. View from Gilbert Hill across Prosper Valley.

It was a hazy, midsummer day when I first stood in the field that stretches along the spine of Gilbert Hill. Beside me was a stonewall that marks the town line between Pomfret to the northeast and Woodstock to the southwest. But, this was one time when I wasn't thinking about stonewalls—the breathtaking views from the ridgeline had entirely commandeered my thoughts. Looking across the Prosper Valley, I could glimpse, through the haze, the surrounding hills and distant ridgelines. Below, I could make out the Gulf Brook—actually the trees lining its banks—snaking through hayfields and front yards. I took a seat on one of the wooden benches in this rectangular field and began thinking about the landscape shapes that had become familiar and cherished over the summer: the narrow valley, the rounded hilltops, and the steep hillsides, becoming gentler on the approach into Woodstock. How had these landforms come to be? Could Gulf Brook, a small stream, have shaped these impressive landforms?

Geologists claim that the Valley's landforms are the result of a long partnership between rock and water. Much has changed since the time hundreds of millions of years ago when the young Green Mountain sediments that had eroded into the Iapetus Ocean were uplifted to become the bedrock now underlying the Prosper Valley. Apparently, pressures from long-ago continental collisions caused the bedrock to crack, thus determining the course of most of the streams in the Prosper Valley. Because

fractures exposed an increased surface area to the weathering agents of water, air and acids, materials near the cracks were more quickly dislodged and removed by ice and water. It is similar to a birthday cake that's cut before glazing—as you pour the glaze, little bits of cake from the cut edges float away. Over time, weathering of weakened bedrock zones established stream channels. Major topographical features, like the Green Mountain belt and its foothills, come from large-scale geological events, but smaller-scale hills and valleys, like Mount Tom and the Barnard Gulf, probably originated by this kind of gradual weathering of weak zones of bedrock. The numerous streams draining into the Gulf Brook have carved valleys that are oriented roughly east-west. This pattern on our present-day landscape reflects the orientation of bedrock-cracking associated with continental collisions that occurred hundreds of millions of years ago.

Geological and hydrological processes have interacted to sculpt the topography of the Prosper Valley, to establish where we see hills and where we see valleys. Simultaneously, the topography has directed the water's path. From the farthest highlands drained by the Gulf Brook's small tributaries to the low farm fields lining the widened Gulf Brook, water connects every square inch of land in the Prosper Valley. Any rain or snow that falls just inside the highest surrounding ridgelines—if not evaporated or usurped by plant roots—will make its way to the Gulf Brook, then the Ottauquechee and Connecticut Rivers, and eventually the Atlantic Ocean.



A Watershed Divide. Stonewall atop Gilbert Hill dividing the Barnard Brook (to the left) and the Gulf Brook (to the right) watersheds.

The Prosper Valley is, therefore, a *watershed*, an area of land that drains into a common body of water. In this case, that common body of water is the Gulf Brook. The long-since forgotten stonewall that I discovered marking the boundary between Pomfret and

Woodstock on Gilbert Hill also marks the boundary between the Barnard and Gulf Brook watersheds. Water that falls on the northeast side of the stones eventually flows into the South Pomfret valley and the Barnard Brook while water that falls on the southwest side of the stones contributes to the Gulf Brook. While town boundaries are often arbitrary lines drawn on a map, watershed boundaries are ecologically meaningful bounds of interacting ecosystems; they govern the flow of nutrients, sediments, pollutants, and aquatic life. Because all of these systems are connected, a change in any of them can have profound effects on countless plants, animals, and humans throughout the watershed and beyond. For this reason, members of a watershed community—whether they be plant, animal, or human—share a common experience, now and in the future.

The shapes that geologic and hydrologic forces have afforded the Prosper Valley have also affected people. The bedrock-defined waterways were primary travel-routes for European settlers venturing northward from Connecticut and Massachusetts into the Valley. And, before the ease of modern transportation, the hollows and valleys defined people's communities. Today, this topography bestows the very landforms to which we humans connect and from which we derive a sense of place and belonging. And, in this way, ancient cracks in rocks have created community.

THE PROSPER VALLEY VIGNETTES:

In the Wake of Ice – Prosper Valley Surficial Geology

Pencil-drawn Sketches. Hinesburg, VT. Aerial view of the Champlain Valley's eastern hills; note stonewalls.

I had lived in Vermont for almost three years before I first realized why the Vermont forests had always felt so different from the Virginia forests of my youth. Flying out of Burlington Airport to visit my family for the Thanksgiving holiday, I was captivated by what, through the plane window, looked like pencil-drawn sketches all across the wooded hills bounding the Champlain Valley. As I focused my vision, the pencil-strokes turned into miles of stonewalls—exposed by the stark nakedness of winter. I had spent the past summer wandering the hills and hollows of the Prosper Valley and hardly a field day passed that I didn't hop across, or clamber over, half a dozen stonewalls. But, never before had the extent of Vermont's stonewalls been as apparent as it was that day from my airplane vantage.

Above Virginia's Blue Ridge Mountains, the only linear features visible from the tiny window of my puddle-jumping plane were streams, roads, and power lines. Where were the stonewalls? Maybe this one feature is why Vermont's forests have always felt different from Virginia's. Why is one place interlaced with stonewalls when the other has not a loose stone in sight? I don't think it was that the early Virginians never reduced their supply of trees for the construction of wood fences—as the early Vermonters had when they began relying on stones for fencing. And, I don't think it

was because Virginians liked to plow rocky fields. Maybe they just didn't have rocky fields—but, why would that be?

I soon discovered that the striking difference between the two landscapes is partly attributable to a process occurring thousands of years ago—not to a difference in opinion between nineteenth century Virginians and Vermonters about what material constitutes a good fence. Around three million years ago the most recent ice age began, triggered by cooling climates and a buildup of snow. Glaciers form when the weight from snow buildup at high latitudes causes snow compaction into ice. Eventually, pressure from the weight of the ice causes it to radiate in all directions. Precipitation continually replenishes the ice pack atop these *spreading centers* and fuels further ice expansion, called a glacial "advance". During the last ice age, the most recent ice sheet to advance across North America was the Laurentide ice sheet. It originated in central Canada around 120,000 years ago and spread over central and eastern North America, resulting in a layer of ice at least one and a half miles thick above Vermont. During warm interludes, ice sheets melt faster than they advance, causing the glacier to "retreat". The Laurentide ice sheet reached its maximum southerly extent around Long Island roughly 25,000 years ago and retreated across Vermont between 16,000 and 13,000 years ago.

Thus, Virginia was out of reach of the Laurentide ice sheet. But how does that explain the absence of rocky fields? When most people think about glaciers and the effects they have on the land, they liken them to bulldozers, plowing across vast areas and tearing up everything in their path. Glaciers do sculpt the bedrock lying beneath them as they advance across the land. The characteristic, asymmetric shape of Camels Hump is one noticeable example. However, the bulldozing action by glaciers doesn't alone explain Vermont's rocky fields. Like a conveyer belt, glaciers pick up materials from one place and ultimately relocate them to another—close by or far away. Yes, on their advance, the glaciers reshaped the peaks and widened the valleys but, most significant to Vermont stonewalls, they picked up most everything loose that covered the bedrock. The glacier was like a molded jell-o salad, with boulders, rocks, sand, soil and trees

inside rather than chunks of pineapple, cherries and pear. The explanation for Vermont's stony fields is in what the glacier left behind; as it melted and retreated from Vermont between 16,000 and 13,000 years ago, it left carpets of "fruit-cocktail" in its wake.

Now, this wouldn't have been appetizing fruit-cocktail—it would have been smashed to smithereens under the weight of the glacier. This heavily compacted glacial debris is what geologists call *glacial till*. Till is the most widespread *surficial deposit*—earth material deposited atop bedrock by glacial processes—in the Prosper Valley. As the ice sheet melted it left behind anything that had been enclosed by the ice. The result was a compact collection of rocks of different shapes, sizes, and origins plastered to the bedrock that lay beneath. Glacial till, first plucked off Vermont landforms during the glacier's advance and then spread haphazardly across the land during the retreat, is the source of stones in the quintessential Vermont stonewall.

Walls of "fruit cocktail". Stonewall dividing Woodstock and Pomfret that is composed of glacial till.

And so, the reason for the lack of stonewalls in Virginia lies in the simple fact that it was beyond the reach of the last glacier, and therefore, not subject to glacial bulldozing or conveyer belt exploits. As you remove the annual crop of rocks from your Vermont garden this spring, imagine the massive glaciers that left behind those rocks. As I do, I will feel brethren to the strong, spirited person who struggled to survive on the land two centuries ago by heaving large stones from the earth and—sometimes artfully, sometimes not—creating a wall.

By Corrie Miller, Winter 2006/07

THE PROSPER VALLEY VIGNETTES:

Stories Beneath the Surface – Prosper Valley Soils

It was my fourth trip up Gilbert Hill in Woodstock and Pomfret—and I had finally remembered my shovel. I wanted to explore the soil atop the hill but questioned my sanity as I hauled the heavy shovel through the network of trails I had come to know—turn right here for stunning views of the valley where the Gulf Brook widens and flattens for its final stretch before convergence with the Ottauquechee; turn left there to explore a lichen-covered rock pile reminiscent of farmers past; and continue straight up to a beautiful sugar maple forest.

Shining Soil. Mica flakes sparkling in the sunlight from soil uncovered atop Gilbert Hill.

At first, I was a little shovel-happy and began digging holes in this hilltop forest with no real aim in mind. But, my enthusiasm was swiftly stymied by something I hadn't fully considered—digging is hard work! With each heave of the shovel, the clang of metal against rock reverberated in my ear. Some of the rocks were large and soundly-rooted while others were small and loose; but both types were keeping me from my vision of a deep, smooth-sided soil pit. The rocks shattering this vision were pieces of *glacial till*—the earth materials left behind by the glacier on its retreat northward 13,000 years ago. From the looks of the matrix around these rocks, the soil was being formed directly from the glacial till; it contained thousands of tiny specks of the mineral mica. I had seen this mineral all summer shining out, like a starlit sky, from many rocks I discovered in the Prosper Valley. Astonishingly, these minerals—originally eroded from long-gone mountains, then deposited as sediments on an ancient ocean bottom,

next part of the Prosper Valley's bedrock, and subsequently part of the glacial till—are now in the soil! I wondered where they might show up next.

That's the exciting thing about soil—it is the interface between the non-living bedrock and surficial deposits that lie beneath and the living organisms existing above. As the "parent" rock—whether it be bedrock or glacial deposits—is broken down by water and tree roots, the soil incorporates the resulting minerals. At the same time, plants, animals and fungi above the soil surface contribute organic material to the soil. It is in this way that soil acts as the liaison between non-living minerals and living plants and animals.

Of Another World? A suspicious canopy opening where lichen and moss grow in thin soil atop bedrock.

Long past geological events, however, are not the only factors affecting the Prosper Valley's soil. Humans too have had a hand in determining soil quality in the time since the glacier's retreat. Once this summer, when I was walking through a shaded forest understory, I detected sunlight shining through the trees ahead. In the split second when my eyes were adjusting to the brightness—as I stepped from the shade into the light—I felt like I had teleported to some far off planet. The area around me was treeless and the only vegetation consisted of lichens, mosses and grasses. There were scattered bare rocks exposed at the surface. In exploring this strange place I determined that the only ground covers were hardy varieties that could tolerate poor soil—reindeer lichen, hair cap moss, and poverty grass. The rock beneath these plants was evidently contributing few nutrients to the soil. But what fascinated me more was the soil itself—it was surprisingly thin. My inquiry might have stopped there had I not found half a dozen other sites just like this in other parts of the Valley. Why was the soil so thin in these places? Why hadn't more

soil developed in the 13,000 years since the glaciers had "bulldozed" through and removed everything off the bedrock surfaces? One answer, I believe, lies in something else that bulldozed these lands—Merino sheep! When European settlers first moved from Connecticut and Massachusetts to Vermont, they encountered a landscape roughly eighty percent forested. They first established subsistence farms but, with the rise of a market for wool, farmers began to raise sheep. These sheep required significant pasturelands; after a few decades, only twenty percent forest remained. The combination of major forest removal—amplified by sheep's practice of eating right down to the plant root—and millions of hooves tromping over Vermont's hills resulted in muddy waterways and bare hilltops. The sheep era was accompanied by the exodus of hundreds of thousands of tons of soil from Vermont's hills. Because soil development is a slow process, a visit to the places most decimated by sheep hooves feels like an interplanetary voyage.

I remember the day I stood atop Gilbert Hill, shovel in hand, questioning the destiny of the tiny, sparkling mica flakes that geologists have traced from ancient mountains to ancient seas, to the Prosper Valley bedrock and glacial till. They are the same minerals I now see sparkling from the soil across many Prosper Valley hilltops. In thinking about sheep hooves and soil erosion, I now have a pretty good idea where those mica minerals might be headed next—right back to the ocean to start the cycle all over again!

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THE PROSPER VALLEY VIGNETTES:

Of an Unusual Wealth – Prosper Valley Vegetation

I was tromping around the Barnard Gulf on what must have been the hottest, muggiest, and buggiest day of the summer. The haze hung in the air, the sweat ran down my back, and the black flies went wherever they pleased. And, unfortunately, it also happened to be the first (and only) day I wore shorts. However, had the heat, humidity, and biting insects been the only things to assault my senses that day I might have forgotten the experience altogether, but this was one to remember. It became the day that I found myself stuck between a rock and a hard place. The "rock" was a steep bedrock slope and the "hard place" was a tremendous patch of stinging nettle plants. I paused to weigh my options—confronting the nettles seemed like a better one than scaling the steep, rocky slope. After I made it through the first patch of biting plants and saw another ahead, I realized that it would be equally bad to go back as to keep going. So, I let my tingling legs make the decision. The slope I started up included sections of vertical bedrock outcrops broken by sections of relative flat. As I made my way through the rough terrain, I started to notice some of the herbaceous plants that carpeted the slope. There were dense blankets of pale touch-me-nots and white snakeroot, pockets of wild ginger and blue cohosh, and clumps of plantain-leaved sedge, Goldie's fern and Braun's holly fern. Though this was the first time I had seen these two relatively rare ferns, I'd seen the other plants at various locations throughout the Prosper Valley—and they were always together. Why was I seeing these species here on this rocky slope? And, why were

Enriched Rock. Steep slope with set of plant species consistently located together: pale touch-me-not, white snakeroot, wild ginger, blue cohosh, plantain-leaved sedge, Goldie's fern, and Braun's holly fern.

they always together?

The answer is wealth. Not wealth in the way we humans may think of it—possessions, property, or riches, but wealth according to plants—nutrient wealth. Because soils form from weathering rock, whatever minerals are sequestered within the rock contribute to the soil; soils forming atop *parent material* rich in nutrients are *enriched* with these same nutrients. Certain chemicals that exist in rocks, like calcium, are essential nutrients for plant growth. Thus, soils differ in the quantity and quality of nutrients they offer plants based on the underlying rock. Furthermore, soils containing calcium not only physically supply the calcium for plant growth, but also chemically alter the soil environment so that plants can actually use the calcium. These soils are therefore more fertile, or *rich*.

But, how does this resolve why certain plant species tend to grow together? As it turns out, the plant species I came across that day in the Gulf, and elsewhere throughout the Valley, prefer enriched soils and are the most competitive plants in them. Hence, one can draw inferences about the soil of a particular site if these plants are growing there. Their competitive advantage causes them to be known as *rich site indicators*.

I'd established that the soil on this site was rich, but I hadn't yet discovered its source of wealth. As I balanced myself on the steep Gulf slope, I looked around. The rock I'd seen throughout the Valley that had formed partly from calcium-rich shells of ancient sea creatures formed the steep sides of this hill. It looked like a pocked, Martian rock to me, and was an "impure limestone or marble" to geologists. Evidently, the soil on the hillside was rich partly because the underlying bedrock contributed calcium to it, which enabled this set of rich site indicator plants to thrive.

Plants that indicate something about their physical surroundings are not limited to rich sites. Many herbaceous plants, shrubs, and trees throughout the Prosper Valley grow in similar associations—called *natural communities*—based on different aspects of their surroundings, like moisture, enrichment, elevation, amount of sunlight, and disturbance

Seeping Water. Barnard, VT. Seep natural community where ground water breaches the surface.

A Beaver's Work. Barnard, VT. Beaver-created wetland complex.

Secluded Swamps. Bridgewater, VT. Red spruce-hardwood swamp.

regime. If you walked from the farthest reaches of the Gulf Brook headwaters to its outlet at the Ottauquechee River you would come across countless different natural communities.

In the hills, you might chance upon seeps, where groundwater breaches the surface, soaking your feet and supplying nutrients from the rock beneath to surrounding vegetation. In the hollows, you could drench your feet in beaver-created wetlands where the beavers' cycle of dam-building and abandonment creates wet meadows of young willow trees and other water-tolerant plants. In the colder highlands, you would hike through shadowy forests of red spruce, red maple and American beech trees. In the lowlands, you would hike around red spruce-hardwood swamps teeming with life. On rich ridges, you might come across sugar maple, white ash and basswood forests, with a carpet of sedges. In the fertile valleys, you might saunter through belts of airy silver maple floodplain forests, with tall ferns blanketing the ground. On

Hemlock Darkness. Pomfret, VT. Slopes of eastern hemlock trees shade the forest understory.

Rich Hilltops. Woodstock, VT. Rich Northern Hardwood forest—composed of sugar maple, white ash, and basswood.

the western-facing slopes, you by chance enter into the darkness of a hemlock forest, with only yellow birch bark acknowledging the sunlight. On the flats, you by chance catch the still eyes of a wood frog peeking out from sensitive fern and skullcap cover along the margin of an ephemeral pool. And, all the while, you haven't left the Prosper Valley. You have, however, encountered significant biological diversity—biological diversity that, for me, was "the spice of life" last summer. I certainly would rather face a choice between a rock and a hard place than to have no choice but face the same landscape every way I turn.

THE PROSPER VALLEY VIGNETTES:

At Home in the Valley Too – Prosper Valley Wildlife

The mid morning sun's white light shone through the sparse foliage and dappled the open page of my field notebook. I was in Barnard Gulf looking for a rumored beaver meadow. As I waded through knee-high sensitive and royal fern, I barely noticed the large black object clambering—quickly but not gracefully—up the hill ahead of me. I suppose the bear had been going about her day in this forest opening when I came onto the scene, had noticed me, and had chosen her moment of exit—all before I even knew she was there. Feeling humbled by this large wild animal's proximity, I walked to where she had stood and tried to locate her tracks. I first saw her big footprint next to a raspberry bush on the outskirts of the wetland. The berries had clearly been the object of her attention.

The Evidence is Everywhere. Black bear scat.

There is something quite different about following animal tracks that have just been created, compared to finding them days or weeks later; my imagination soared as I pictured her day to day life in these woods. Where had she been? Where was she going? Did she have a young one around? Was she a he? I lost her trail when she left the mud for higher ground, but her presence heightened my senses. I began to notice bear sign wherever I went in the Prosper Valley. I found territorial rubs, claw marks on American beech trees, and piles of bear scat filled with berry seeds. That summer, I never again saw a bear but I did strangely feel one's presence whenever I found myself walking through berry thickets.

As I traipsed all over the Valley in the months following my black bear sighting, I began to realize just how well-suited the Prosper Valley is for black bears. It was as if all the layers of the landscape—bedrock and surficial geology, soil and vegetation, and, in some cases, people—had conspired to provide the perfect black bear habitat. Geologic forces have sculpted both the lowlands and highlands that black bears rely on to provide a continuous supply of foods throughout the year. The low, wet areas are the first to have green, herbaceous forage in the spring when the bears emerge, ravenous, from their winter sleep. Then, come summer, when the forest's berries ripen, the bears move all over the woods to take advantage of patches of these high calorie fruits. With the onset of fall, and as the carbohydrate- and fat-rich beechnuts and acorns mature, they migrate to the higher, drier areas that support the trees producing these nuts. In these ways the physical and natural landscapes have collaborated to furnish black bear with ideal habitat. This same figurative collaboration occurs for every wild animal living on earth.

Spring Forage. Low, wet forest opening that provides early spring forage to black bear.

Fall Forage. American beech tree nuts, or beechnuts, are a favorite food of black bears.

Though it is true that physical and biotic landscapes influence wildlife by defining the available habitat, it is also true that animals influence the landscapes surrounding them. Need I describe the ways that beaver alter their landscape? There is a place on Wayside

Road in Barnard that has had beaver occupants for at least the past thirty years. Folks from the Barnard Town Garage have broken the beaver dam there half a dozen times within the last two years because it causes road flooding. But, the beavers don't give up. It's physiological—the sound of running water makes them build. And, for good reason—dam building benefits beaver in numerous ways; it makes the water high enough that they have a safe haven beneath winter ice, maintains wetland ecosystems which support their favored plant food species, and also expands what's accessible to them—flooding makes more trees within striking distance of the safety of water. Beavers are the only animal, besides humans, known to actually create their own habitat.

Beaver Meadow. Years of beaver habitation have created this wetland along Wayside Road in Barnard.

Though the beaver is quite skilled at creating its own habitat, it isn't so adept at sustaining it. Because beavers eat the inner bark of hardwoods but ignore conifers, the forest surrounding the Wayside Road wetland is mainly conifer. In essence, beaver have changed a hardwood forest into white pine woodland and wet meadow, and in so doing, eliminated their immediate food supply. Beavers compensate for their unsustainable resource consumption by practicing field rotation—cycling through several different locations to allow recently depleted trees to regenerate.

After a summer of close observation, I feel akin to the animals that live in the Prosper Valley. In the same way that the physical and natural landscapes bestow sufficient habitat upon the black bear, beaver and countless other wildlife species, they provide a superb habitat for those people the Valley sustains. They determine the types of lives to

be led here and the ways in which people interact with the land. Though humans are influenced by the landscape, they also directly influence it; similar to the beaver, we shape the land to fulfill our own needs. For this reason, I regard the beaver's tendency to use up its habitat as a caution relevant to my own species. Can humans learn from the beaver's oversights before we find ourselves in a metaphorical conifer wasteland with nothing to eat?

THE PROSPER VALLEY VIGNETTES:

Written on the Land – A Prosper Valley Cultural History

Dana Hill. Many relics of an earlier time dot the hilltop.

I don't know what it is I like so much about forests latticed with stonewalls. Partially, I think it's that they fuel my imagination; with the sight of one, I begin to picture how the land used to look when the stonewall was created, and I visualize how it has changed between that time and today. I had explored the entire length of the Appalachian Trail (AT) through the Prosper Valley but I kept coming back to the Dana Hill section in Woodstock and Pomfret. My first trip there had been highlighted by the discovery of giant butternut trees and fields of wildflowers and fluttering butterflies. But what really made the place special to me were the cultural relics that I gradually discovered. That hill, like dozens of others in the Valley, had a story to tell and it disclosed new clues with each passing day—some apparent, some subtle. With each discovery I understood more about the people who once lived on Dana Hill and about the relationship they had with the land.

The first indication that someone had once lived on Dana Hill was the stonewalls. They were everywhere—in the middle of fields, in the middle of forests, and on the edge between field and forest. But, if people had worked this land, where had they lived?

In pursuit of answers, I found myself hiking off trail on AT land, compass in hand, searching for a hole in the ground represented by a little black dot on a really old map. The map was the F.W. Beers Atlas of Windsor County and was created in 1869 (of

course, the one I carried was a reproduction). Mr. Beers denoted the location of all the residences at the time of his survey with a little black dot and the name of the homeowner. So, if I could locate a black dot on the map somewhere on Dana Hill, I would have a better idea about where to look for the nearby dwelling. According to the map, "D. Pingrey" had lived on Dana Hill at the end of Austin Road and just across the Woodstock-Pomfret town line. Once I had an idea where the home site had been, I went on foot.

Bygone Barnyard. Tall stone walls and vestiges of a gate mark the location of Pingrey's barnyard.

I arrived at an old road which, if my orienteering skills were correctly calibrated, was Austin Road. When I'd walked up the road several dozen feet I saw a gate. I went through the gate and let a tall, solid stonewall and a flat belt of ground guide me directly to the remains of a house. Within a matter of minutes I had found the relics of a barn and barnyard. Various domestic plants—lilacs, irises, apple and cedar trees—were scattered around the dooryard, indicating that people had once cared for this land.

How did they live off the land? Did Pingrey have cattle? Did he grow crops? If so, where had the fields been? To that end, I would turn to subtler clues embedded in the landscape.

Historically, stonewalls separated parcels that were used differently, so I set out to inspect the walls lining the hills and the land they partitioned. The forest around me was a bright one, partly because it was a sunny day and partly because the stark white bark of middle-aged paper birch trees shone out from all over the steep slope. I looked down to examine the soil; I found it thin, so thin that there was exposed bedrock in

many places. Paper birch is considered a *pioneer* species because of its ability to colonize degraded landscapes with little soil. What had caused the soil to become so thin on this hilltop? Given that the site seemed too rocky and steep to ever have been cultivated or mowed, I guessed that grazing animal hooves were the answer. I could picture a few dozen sheep or cattle grazing the steep hill, tearing soil from bedrock with each step, and creating the perfect site for paper birch seed germination. Lying in wait beneath the aging paper birch were shade-tolerant sugar maple and American beech—ready, when a birch succumbs to ice, wind or chainsaw, to take its place in the canopy. In this cycle of disturbance and change, paper birch *pioneers* the way for tree species that settle later and ultimately persist longer.

As the sun moved across the sky, I continued to explore the fields and forests on Dana Hill. I found rock piles where farmers had chucked rocks they moved from the plow's path and I found flat expanses of forest that had once been plowed. I found areas with several old, and hundreds of young, sugar maple trees that surely had been a sugarbush. And I found gnarly apple and pear trees where there had unquestionably been an orchard.

Hidden Stones. Rock pile marking division between cultivated field and hillside pasture.

On my first visit to Dana Hill, the fields were full of beautiful flowers—some native, some not. Many of the non-native species, like timothy and clover, were remnants of Dana's agricultural past. By my fourth trip to Dana Hill, the fields had been mowed and the flowers replaced by unconcealed cow pies. Evidently, Dana Hill's agricultural tradition continues into the present through agricultural leases and people's lasting relationship with the land. There is something poignant about standing in a place that

has been farmed for over two centuries. Legacies of the early settlement are in the stonework and the vegetation all around. Together these clues reveal a story of people who came before—a story of how their livelihood depended on the land and shaped its future. And now, as the forest slowly reclaims the borrowed stones, the stonewall is a reminder of the linkage.

THE PROSPER VALLEY VIGNETTES:

People and the Land – Prosper Valley Connections

At the beginning of the summer I thought that I could study the Prosper Valley's natural landscape without considering the community of people living there; I assumed that the lines between natural and cultural would be clear. I thought that if I explored the steep, bedrock slopes, the flat, soggy fields, and every inch in between, I would somehow *know* the place.

I had been naïve; the truth is that there are no lines between natural and cultural landscapes. Every day I spent on the land proved that the natural landscape is inextricably linked to the people who share it. The influences of humans on the land were sometimes obvious, as when a farmer suspended forest succession by pasturing cattle in a field, and sometimes subtle, as when a landowner had removed a few dozen trees each year for firewood. But, even when I walked through the deepest, darkest woods and felt far from the influences of people, I stumbled over stonewalls or into forests of paper birch trees and was reminded that people had once farmed even those hills.

In general, I honored this link between people and the land, but on several occasions during the summer I felt a wave of sadness come over me from the sight of houses being erected in new, geometric gaps in the forest cover. This, in combination with stories from landowners about being unable to pay their property taxes and needing to sell their land to developers, seemed to foreshadow a wave of change that threatens the Prosper Valley I came to know and love—the charming rural character, the uninterrupted ridgelines, and the incredible wildlife habitat. I became bogged down in thinking about the complexities of such a problem and it was not the trees and animals that continually pulled me from the mire, but the people of the Prosper Valley.

Where I found wetlands, I also found the woman who has made it her mission to protect them. She led me on a walk through her woods to some of the treasures hidden within—a vernal pool here, a red maple-black ash swamp there. She explained how the health of wetlands throughout the Valley is tied to everything else—the region's water quality, wildlife habitat, and entire ecosystem functioning.

I was caught in an afternoon thunderstorm with someone who'd offered to show me around his land along the Gulf Brook. We knew the storm was coming when we took off down the old roadbed, but I think we both welcomed the rains. As we walked, he told me that he'd grown up in the area, gone away for much of his adult life, and then was drawn back in his latter years. While the rain drenched us, he told me stories of the critters that used to sneak from the stream banks into the chicken coop to make off with dinner and showed me where the beavers had entirely changed the brook's course.

Overtapped. Patrick Bartlett, a local forester, displays a tree cookie with maple tap scars. Photo by Sarah Bursky.

A local forester who knows the region's hills and hollows like the back of his hand drove me to see an in-progress logging job. He picked up a tree cookie—a horizontal slice of a tree trunk—that was lying on the ground amongst sawdust and pointed out many discolorations radiating from the center. The tree had been tapped for maple sap too heavily at the same height; these discolorations marked the location of scar tissue.

On one very hot summer day, a Barnard Gulf landowner invited me into her home for iced tea and conversation. She told me about how she makes sure the woods roads on her land are maintained so that she can walk through and enjoy the forest. She

listened thoughtfully as I shared about interesting places I'd discovered on her land and lamented the days when she could easily ascend to the highest vista.

Two local farmers—a father and a son—gave me a ride in the back of their pickup to the open fields on Dana Hill. The father recollected the building that once stood in the hollow between scraggly lilac bushes and suggested that the tall stonewalls we saw once enclosed a barnyard. The son recalled childhood explorations of the hillside and the scattered vestiges of a farming past—he immediately directed us to a sunken stone cylinder that had clearly been a well.

As I ate lunch, sheltered from the drizzle by the Appalachian Trail's Winturi shelter, I paged through the guest notebook and noticed an entry by someone with a familiar name. He was a nearby landowner who'd been out exploring the land between his home and the trail. A few weeks later I visited him and he led me along a footpath into his woods and wetlands. We passed a cellar hole and collection of stonewalls as he told me stories of the forester who used to work the land and shared his own theories about where the farm fields had once been.

All these conversations with Prosper Valley community members reminded me that many people in the Prosper Valley feel a connection to the land and the landscape. And, though the stories tell of different kinds of connections—some people aim to protect wetlands they understand to be so important, some people preserve the land's history with their memory, some people work hard to see that the land is managed well for the future, and others simply enjoy a walk in the woods—it is these connections between people and the natural world that make a place. And it just might be these connections that save it.