Mills: the Link Between Hydrology and Town Citing

Madison Stebbins

Geology

Waterfalls occur at a location known geologically as a knickpoint. When viewed in profile, a waterway should ideally appear the same as an exponential growth curve—very steep at higher altitudes, but as the stream or river closes in on a body of water (in this case, Lake Champlain), the grade of the slope levels out. In actuality, some of the layers of different types of soil and bedrock underlying a river or stream are eroded more easily than others. Mudstone is an example of an easily eroded rock, while quartzite or granite with their high quartz content are much more difficult rocks to erode. This variation in rate of erosion creates step-like discrepancies causing an actual stream profile to look similar to an irregular staircase.

There are three commonly accepted explanations as to how knickpoints are started. Knickpoint creation in the Champlain Valley is the topic of current research. It's indeed possible that a combination of these theories is involved with the waterfalls we see today. The three theories are resistant bedrock, faulting, and base level drop (not pictured).

Resistant Bedrock (Fig. 1a)

These knickpoints are locations where the flow of a waterway has eroded overlying softer layers of soil and bedrock until it hits a particularly hard layer of rock. It is worth noting that knickpoints are not stationary. Although the top layer of rock at a knickpoint is often much harder, it still erodes. The flow of water over a knickpoint also erodes the softer layers of rock underneath the knickpoint and causes a waterfall to migrate upstream until it returns to a graded state.

Faulting (Fig. 1b)

Faults occur when rock, which is relatively brittle under the conditions at or near the Earth's surface, breaks from stress. These stresses have several causes—primarily tectonic activity or weathering associated with the freeze/thaw cycle or unloading. When a break in rock and its subsequent settling intersects with a waterway, a knickpoint is formed.

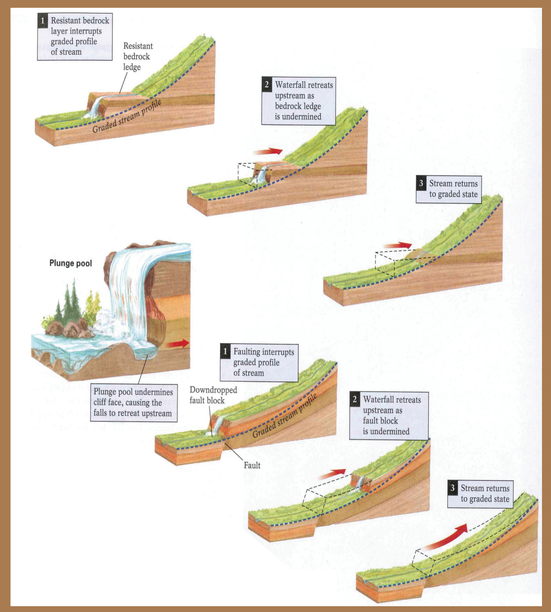


Figure 1a & b. Progression of a knickpoint caused by resistant bedrock up a graded stream profile (a). Progression of a knickpoint caused by faulting up a graded stream profile (b). Chernicoff & Whitney .

Base Level Drop (not pictured)

If for some reason a stream or river undergoes a sudden drop in base level (the lowest point that a waterway can flow to), a knickpoint is created at the old shoreline. The retreat of a glacier is one example of an event that can cause a significant enough reduction in base level for a knickpoint to be created.

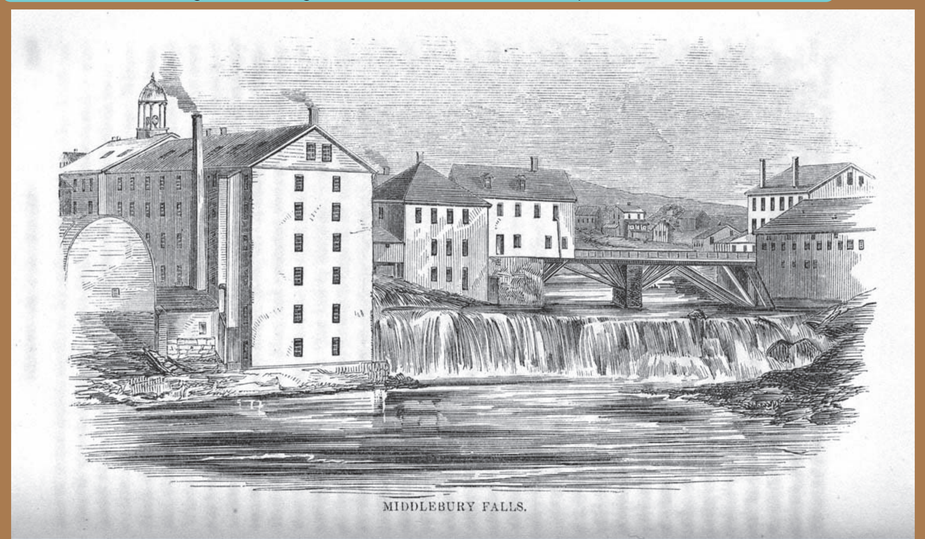
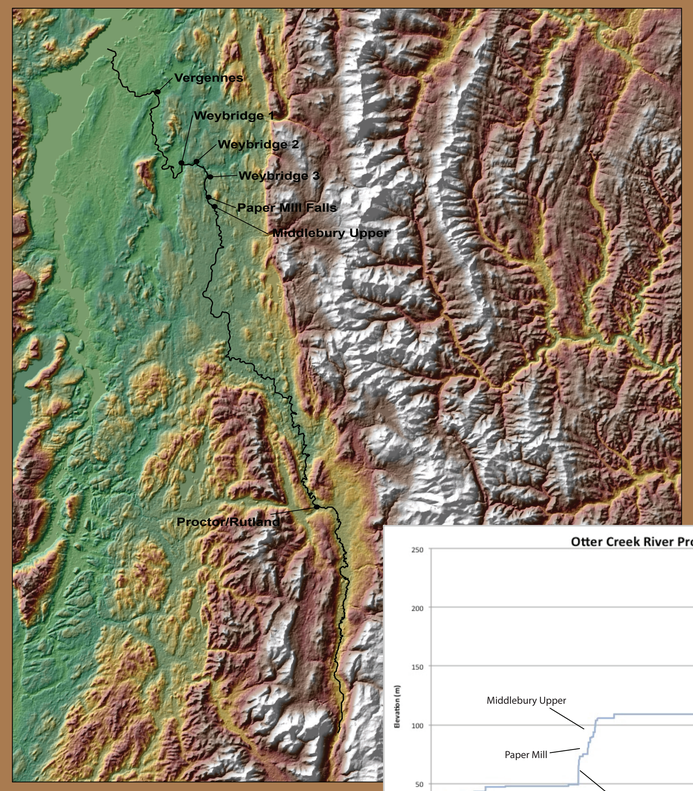


Figure 2. Etching of the mills on Middlebury Falls (Middlebury Upper) before the 1891 fire. Note that there is no mill pond—all mills are run of the river. From Middlebury town history p. 14.

Introduction

Many towns in Vermont, and the Otter Creek Watershed in particular, are located on or near natural falls. This method of town siting may seem like a peculiar choice today, but at the time of settlement, natural falls were a highly desirable commodity. These falls provided a location for mills to be built, and towns themselves were often built up around mills.

Towns grew up around mills because they provided an avenue for industry--beyond agriculture. Mills were the first non-farming method of revenue, and opened the door for the next tier of development.



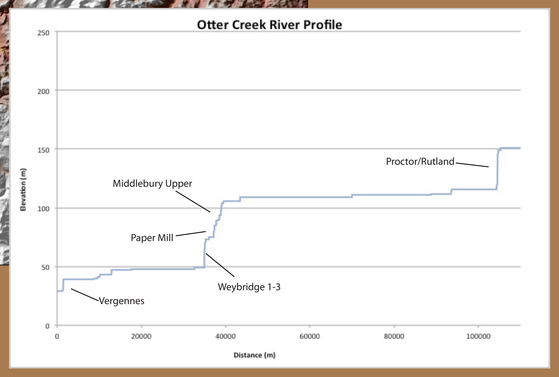


Figure 3. Topographic map of the Otter Creek Watershed and Otter Creek River Profile with labels representing towns on Otter Creek. Note the correspondence between towns and knickpoints. Base images courtesy of Will Amidon.

References

Albers, Jan. Guest lecturer & local historian, 1/24/11

Chernicoff, Stanley & Donna Whitney. *Geology.* 4th Ed. Upper Saddle River, New Jersey: Pearson Prentice Hall, Inc., 2007.

Goodhue, Rev. Josiah F. Town History of Shoreham. 1861. (http://midddigital.middlebury.edu/SharingVTHistory/BooksPamphlets/HS/Directory.htm)

Sanford, Beulah M. Town History of Cornwall. 1962. (http://midddigital.middlebury.edu/SharingVTHistory/BooksPamphlets/TCCL/DirectoryTCCL.htm)

Swift, Samuel. Town History of Middlebury. 1859. (http://community.middlebury.edu/%7Ewamidon/swift_addison.pdf)

Special Thanks to Will Amidon and his thesis student for creating the watershed map and river profile of Otter Creek.

Figure 4. Photo of Pierce Sawmill from the early 1900s. Courtesy of Rochester Historical Society ((http://www.rochesterhistorical.org/?page_id=226) .

Mills

Mills require a drop in elevation in order to create the energy from falling water that provides power to turn a waterwheel. Although it is possible to dam a waterway to a millpond, and the necessary height differential; many mills in Vermont were placed on natural falls, which saved would be millers the time and effort involved with damming their chosen waterway.

Mills are not always found at the center of town—in fact they are often closer to the outskirts, but nearly all towns in the Otter Creek watershed have a mill nearby.

The presence of a sawmill provided an affordable means for procuring boards for housing (the alternative being shipping boards from the distant sawmills in New York or New Hampshire—an undertaking that was not a realistic option for the initial settlers of Vermont). Houses built with sawn boards were more desirable and easier to build than houses built out of full logs.

Gristmills also provided an invaluable service to early Vermont settlers. A local gristmill provided a way for area farmers to mill their grain into flour. Gristmills were essential facets of early Vermont society since bread was a chief component of a farmer's diet.

Mills initially provided settlers with products they were otherwise unable to get. Later on mills, particularly woolen mills, in the Otter Creek watershed provided a major source of employment for Vermont residents.

Middlebury Mill History

Middlebury has some of the best falls for mill citing in the Otter Creek Watershed. The town history references cotton and gristmills on the East side of the falls in town (Middlebury Upper) and on the West side a wool mill, gristmill, sawmill and pail factory. Three quarters of a mile downstream at Paper Mill falls, there is a furnace and machine shop on the East side and a paper mill, oil mill, sawmill, carding machine and trip hammer shop.

This extensive list of mills all provided for by the falls on a one-mile section of Otter Creek is evidence for the fact that Middlebury has had both the largest population size and highest population density in the region for the vast majority of history. The mills on Middlebury and Paper Mill falls alone provided the industry to create employment and economic opportunity for Middlebury to grow dominantly in the region both in population and economically.