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Thoreau on Monadnock: A Philosopher Naturalist's Observations on Geology

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Henry David Thoreau visited Mount Monadnock on four occasions: a solo overnight on the summit in 1844, a one-day jaunt in 1852, and more extended stays in 1858 and 1860. He recounted in his *Journal* how he heard from a Peterborough, New Hampshire, man about the great fires that destroyed the forest and soils on Monadnock around 1800. The settlers had set fire to brush piles around the foot of the mountain to drive out wolves, and when the fire got away from them, the whole summit went up in flames. Thus, the treeline was artificially lowered, producing one of the largest exposures of continuous bedrock in New England. Thoreau wrote, "but what a study for rocks does this mountaintop afford!"

Thoreau made copious notes on the trees and plant communities of Monadnock—his interest and training in botany clearly outshone his geological background. He observed that the plants on the summit are suited to arctic conditions, "conditions as in the north of Maine and in the fur countries." He wrote that the juncos nesting on Monadnock had "discerned arctic isles sprinkled in our southern skies." Monadnock was already a beacon to human visitors, and although Thoreau lamented the "newspaper and eggshell" left behind, he took the long view and predicted that names chiseled into the rock would soon be reclaimed by "bog and lichen."

Today, the summit is purported to be among the most climbed in the world, second only to Mount Fuji. Thoreau wrote, "It is remarkable what haste these visitors make to get to the top of the mountain and then look away from it—the great charm is not to look off from a height but to walk over this novel and wonderful rocky surface."

He explored the whole mountaintop and made a passable map using a compass and estimating distances "very rudely by casting a stone before [me]." After descending in 1852 he wrote, "We could see that the mountain had spurs or buttresses on every side . . . an interesting feature in a mountain. I have noticed that they will send out these buttresses every way from their centre." The mountain seems almost to will its own shape in this passage.

During his longest stay, Thoreau built a rough shelter on the plateau southeast of the summit. Today it's difficult to locate the exact spot where he camped amid the miniature spruce forest, but he described how the rock layers near the campsite tilt toward the summit. He noted how the layers on the west side run north–south and dip to the east about 60 degrees.

The fires that destroyed the forest on top of Mount Monadnock created a huge lesson in the history of rock, Thoreau believed. JERRY AND MARCY MONKMAN

But somehow he missed the huge isoclinal[1] fold just west of the summit, which was pictured as the frontispiece to Marland Billings's 1942 *Structural Geology* (Prentice Hall) textbook. Or perhaps he saw the fold and found in it "strains from the music of Chaos, such as were heard when the earth was rent and these rocks heaved up." Those words were inspired by the sound of nighthawks, swooping in the dark over the mountain. "I could imagine their dainty limping flight, circling over the kindred rock, with a spot of white quartz in their wings." (Bird-shaped structures can be seen in the rocks, which are the top half of schist boudins[2] with the light gray quartzite layer folded down into the neck line.)

He refers to "bright purple or wine-colored garnets," which he'd read about in the 1844 *Report on the Geology & Mineralogy of the State of New Hampshire* by C.T. Jackson, which described Monadnock geology as "mica-slate and garnet-bearing gneiss." But typically, the garnets in the schist at Monadnock are tiny. Curiously, he omits mention of the much more conspicuous sillimanite crystals in the rocks on the mountain, which modern visitors refer to as turkey tracks.

Thoreau was fascinated by the arrangement of joints and shapes of rocks on the mountain. He struggled to explain what he observed, conjuring up earthquakes and Titans, but he never mentions glaciers. Yet he describes again and again features that we would recognize as glacial in origin, such as erratics, striations, and roches moutonnées. He wrote, "The rocks which you walk over are often not only worn smooth and slippery, but grooved out, as if with some huge rounded tool, or they are much oftener convex."

Thoreau had read Charles Lyell's *Elements of Geology* (John Murray, 1838) and thus was influenced by uniformitarian thought ("the present is the key to the past"). However, in the 1850s, geology was in the midst of a paradigm shift with respect to interpreting glacial features. Edmund Bolles's 1999 book *The Ice Finders* (Counterpoint) emphasizes the importance of Elisha Kane's *Arctic Explorations* (American Publishing, 1856), which describes the Greenland continental-scale glacier. Acceptance of the idea of a North American ice sheet was slow. Some, like James D. Dana at Yale, had embraced the idea, but others, including those who were publishing works on New England geology, preferred a diluvial origin, whereby the sea dragged the rocks and

[1] An isoclinal fold is one where the two limbs of the folded rock layers are nearly parallel. They are inclined at the same angle.

[2] A boudin is a layer of rock that was stretched but did not respond uniformly, instead forming a string of sausage-like shapes. *Boudin* is the French word for sausage.

icebergs across the landscape at a time when sea level was higher. Although Thoreau had met Louis Agassiz and read his 1837 ideas on glaciation (*Etudes sur les glaciers*, first published in English in 1967 by Hafner of New York), he also had read Jackson (who was Emerson's brother-in-law): "Agassiz theory originated among the glaciers of the high Alps . . . but it is, by no means, applicable to the wide spread drift of New England. . . . Grooves should radiate from mountain tops, not cross them." The Massachusetts geologist Edward Hitchcock in 1856 was not yet convinced by evidence for continental glaciation in North America, but by 1874, when his son Charles Hitchcock published *Geology of New Hampshire* (New Hampshire Geological and Mineralogical Survey), the diluvial theory had been abandoned in favor of glacial drift. Around the same time, G.A. Wheelock made a systematic study of striae on Monadnock ("Striae on Mount Monadnock" in *The American Naturalist*, 1873). Ralph Waldo Emerson visited the summit of Monadnock in 1866 and noted "the uniform presence on the upper surface of the glacial lines or scratches, all in one self-same direction."

What did Thoreau think about all this? We don't know. The only hint of Thoreau's attitude toward Agassiz's Ice Age theory—and it's only a hint—comes from the one direct reference to Agassiz in Thoreau's *Journal*, when he wrote about Monadnock. Thoreau is speculating on how amphibians came to be on the summit: "Agassiz might say they originated on top. Perhaps they fell from the clouds in the form of spawn or tadpoles . . . . I think it more likely that they fell down than that they hopped up." Could this be a reference to Agassiz's Ice Age theory, whereby each ice age resulted in worldwide glaciers that wiped out all life forms? Agassiz's theory required a whole succession of creation stories rather than just one.

Perhaps Thoreau's most original observations have to do with Monadnock's hydrologic cycle. He found it astonishing that pools and bogs lie directly next to "the most barren and driest spots . . . . You step unexpectedly from Arabia Petraea, where the lichens crackle under your feet, into a miniature bog, say Dismal Swamp." He concluded that the small ponds around the summit are not spring-fed, but rather more like rainwater cisterns. He speculated on the balance between rainfall, fog, and evaporation, concluding that the coolness on the mountains lowers the evaporation rate compared with that at lower elevations. And although Thoreau never visited Monadnock in winter, he describes how the spruces spread out their branches close to the rock in response to the harsh winter winds. Out on the northeast spur of the mountain, two of the larger bogs have been named after Thoreau. He spent

many hours exploring these bogs, especially on his 1860 trip. He lists in his *Journal* the grasses, sedges, mosses, and shrubs growing in the bogs.

The bogs lie in the hinge region of a late open fold[3] east of the summit, which deforms the metamorphic foliation associated with earlier, isoclinal folds. Thoreau observed how each bog drains away from the divide between them, one draining north toward the Ashuelot and Connecticut rivers, and the other southeast to feed the headwaters of the Contoocook and Merrimack.

Thoreau did not think of himself as a scientist. Remains of a dead blue jay would more likely inspire for him thoughts of "the science that deals with the higher law" than thoughts on the food chain. He wrote, "I am a mystic, a transcendentalist and a natural philosopher to boot." His trips to Monadnock were an escape from the work and worries of the family's graphite pencil industry; by 1860, his father was not well and Henry bore most of the burden. (The Thoreau family business shifted in 1853 from making pencils, for which Henry had introduced many innovations including a hardness scale, to providing ground graphite for the Smith & McDougal electrotype company of Boston.)

He makes no mention of the small graphite mine on the ridge south of the summit, which was worked from 1847 to 1850. (The graphite was apparently packed in kegs, which were rolled down to the Half Way House site. I can't help but speculate that he knew of this activity and may even have negotiated to purchase the graphite.)

After his last visit, Thoreau wrote, "That area is literally a chaos, an example of what the earth was before it was finished." He saw in the mountain evidence that the Creator was still at work. The language in his *Journal* often leaps back and forth between detailed descriptions and lofty, even fanciful images. It reflects the Transcendentalist tendency to trust intuition as well as rational thought, but also reflects an eighteenth-century emphasis on hierarchy and order out of chaos. As for the somewhat shallow treatment of geological features, perhaps Thoreau would echo Nicolas Steno, the famous seventeenth-century geologist, saying, "Most beautiful is what we do not comprehend."

[3] An open fold has limbs that are at a wider angle than 90 degrees.

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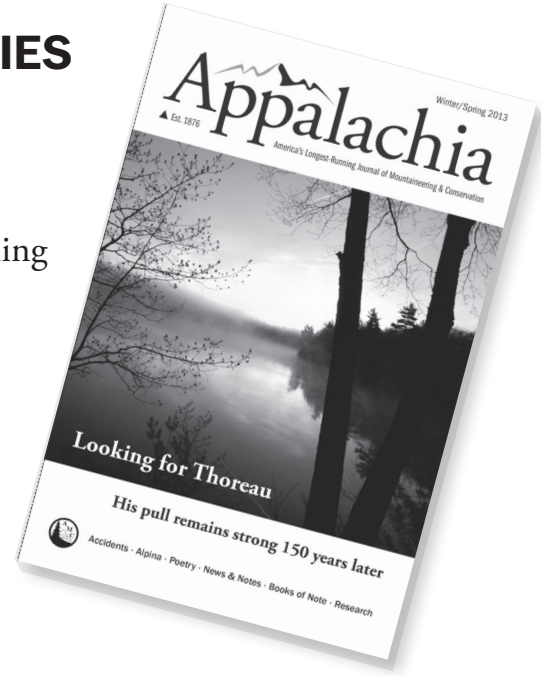

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