Granite, Greenstone, and Geest: Edward Hitchcock and the Geology of Connecticut

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The date was September 11, 1822. In the Gibbs Mineralogical Cabinet at Yale College in New Haven, Connecticut, a small group assembled to observe the third anniversary of the founding of the American Geological Society. Present were many of the leading scientists of the young nation. Most were professors at prestigious institutions such as Yale, Harvard, Columbia, and Bowdoin; several were Fellows of the American Academy of Arts and Sciences. Professor Benjamin Silliman introduced the day's speaker, Reverend Edward Hitchcock.[1]

Then junior pastor of a small church in western Massachusetts, Edward Hitchcock might have seemed out of place at that august gathering. At twenty-nine years he was far younger than most of those in attendance; his formal education amounted to barely six years at Deerfield Academy. But if anyone present harbored doubts about the young pastor's qualifications, those doubts soon were allayed.

I am indebted to the Amherst College Archives and Special Collections for preserving and providing access to the unpublished writings of Edward Hitchcock. I also wish to thank Dr. Joanne Bourgeois of the University of Washington for her comments on an early draft of this article. My thanks as well to Dr. Ellen Thomas of Wesleyan University, Dr. Stefan Nicolescu of Yale University, and Hayley Singleton of the Beneski Museum of Natural History at Amherst College for assistance with my research, and Carolyn J. Mosher for her graphic design services. Finally, I thank my wife, Susan Milsom, for her valuable editorial assistance in the preparation of this manuscript.

[1] The only published record of that meeting is in the title of Hitchcock's discourse (see note 2 below). Details are inferred from accounts of previous meetings that appeared in the *American Journal of Science* 2, no. 1 (1819): 139–44; 2, no. 2 (1820): 372–73; 3, no. 2 (1821): 360–62; and 4, no. 1 (1822): 191–92. That journal is hereafter referred to as *AJS*.

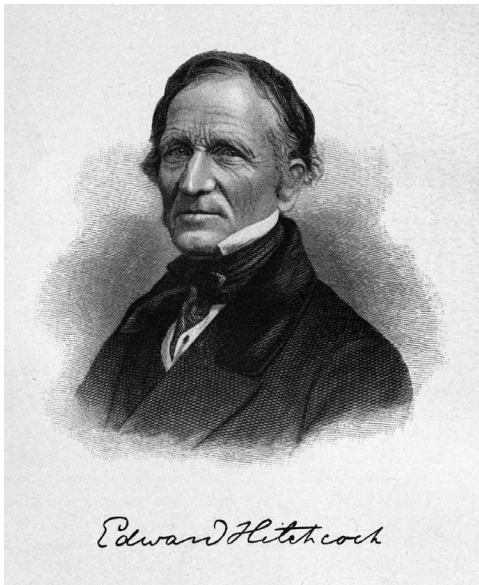


Figure 1. Edward Hitchcock, steel engraving. Source: William S. Tyler, *A History of Amherst College* (New York, NY: Frederick H. Hitchcock, 1895), 116.

Reverend Hitchcock delivered a discourse that day entitled "A Sketch of the Geology, Mineralogy, and Scenery of the Regions contiguous to the River Connecticut; with a Geological Map and Drawings of Organic Remains; and occasional Botanical Notices."[2] His "Sketch" ran to some 55,000 words, making for a very lengthy address. Nevertheless, the young pastor's presentation must have been riveting to that audience, for it was unlike previous works in American geology both in scope and in content. Most published articles on geology in that era were brief anecdotal "notices"—an announcement of a new locality for a particular mineral, for example, or a description of some geological peculiarity such as a rocking stone, an ice cave, or a waterfall.[3] By contrast Hitchcock's study was broad in scope, encompassing some 4,500 square miles of western New England including parts of Vermont, New Hampshire, Massachusetts, and a swath of about one-third of Connecticut. It

[2] Edward Hitchcock, "A Sketch of the Geology, Mineralogy, and Scenery of the Regions contiguous to the River Connecticut; with a Geological Map and Drawings of Organic Remains; and occasional Botanical Notices. Read before the American Geological Society at their Sitting, Sept. 11th, 1822," *AJS* 6, no. 1 (1823): 1–86; 6, no. 2 (1823): 201–36; and 7, no. 1 (1823): 1–30.

[3] For example: Edward Hitchcock, "Southampton Lead Mine," *North American Review* 1, no. 3 (1815): 335–37; F. C. Schaeffer, "On the Peat of Dutchess County," *AJS* 1, no. 1 (1818): 139–40; Jacob Green, "Notice of a Mineralized Tree—Rocking stone, etc.," *AJS* 5, no. 2 (1822): 251–3.

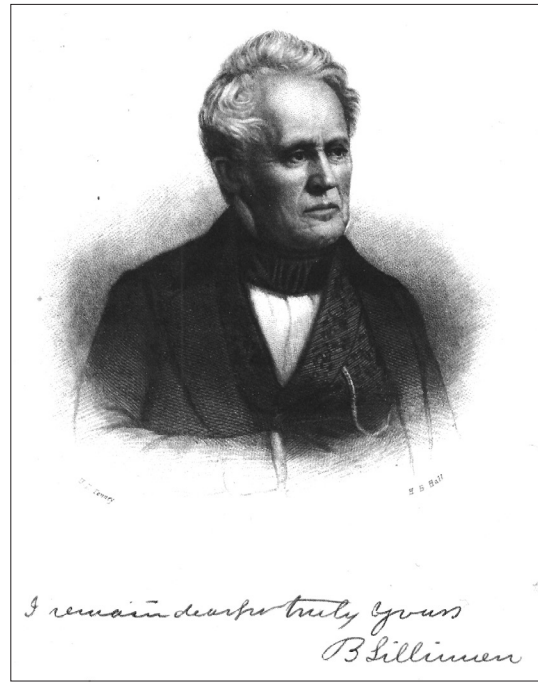


Figure 2. Benjamin Silliman, steel engraving. Source: George P. Fisher, *Life of Benjamin Silliman M.D., LL.D.* (New York, NY: Charles Scribner and Company, 1866), frontispiece.

was analytical and integrative, combining detailed accounts of rock formations, mineral deposits, and fossils with the author's considerable knowledge of the works of contemporary geologists, then drawing inferences about the geological processes that shaped the region. Together with a large, hand-colored map of the geology of the study area, it represented an entirely new genre of geological study in America and a quantum leap in the understanding of the geological history of the region.

How that young preacher with barely a high school education came to be the keynote speaker on such an auspicious occasion and how his presentation influenced the course of American science is an important and largely overlooked story in the history of the Constitution State.

BACKGROUND OF EDWARD HITCHCOCK

Edward Hitchcock (1793–1864) was the youngest of five children born to Justin and Mercy Hoyt Hitchcock in Deerfield, Massachusetts. Justin was a farmer and a part-time hatter; Mercy was the daughter of a prosperous Deerfield family. While the couple managed to provide for their family, they spent much of their married life struggling to pay their debts.

Deerfield was a prosperous agricultural community at the confluence of two of New England's greatest rivers, the Deerfield and the Connecticut. To the east the Pocumtuck Range rose some 600 feet above the village, its backbone of ancient rock laid bare. Given that setting, it is not surprising that a young Deerfield resident might develop a curiosity about the workings of water on the earth's surface and a fascination with the rocks that lay beneath his feet and rose far above him.[4]

After attending a one-room schoolhouse in the center of the village for several years, Edward entered Deerfield Academy in 1804. He was enrolled at the academy for the next six years, although he was often excused from his studies to assist his father and brothers in the fields. At age sixteen he left the academy, choosing instead to undertake an apprenticeship of sorts with his uncle and neighbor, Epaphras Hoyt. "Uncle Ep," as he was known to the Hitchcock family, was a largely self-taught polymath with interests in history, military science, natural philosophy, and astronomy. While Edward found military science and natural philosophy of some interest, it was astronomy that quickly became his passion. For a time, he harbored hopes of entering Harvard, but in 1814 a severe case of the mumps took a toll on his eyesight. Soon it became clear that he would have to give up his aspirations for college and a career in astronomy.

Then, in 1816, seven years after his departure from Deerfield Academy, Edward Hitchcock returned to that institution, not as a student but as headmaster. It was quite a coup for the young man considering that all his predecessors were college graduates.[5] While his tenure as headmaster lasted only two years, it set the course for his adult life in several respects. For one, he worked closely with Orra White, preceptress of the Academy's female students, a well-educated young woman with talents in the sciences, mathematics, and arts. While the young couple shared an interest in the sciences, their religious convictions were at odds: Orra was a devout Calvinist, Edward was a Unitarian. Deerfield at the time was predominantly Unitarian, strongly influenced by Harvard-trained pastor Samuel Willard. In 1816 Edward undertook a course of religious instruction with Reverend Willard but soon found himself in sharp disagreement with his mentor. Eventually Orra succeeded in

[4] For biographical details of Edward Hitchcock see Robert T. McMaster, *All the Light Here Comes from Above: The Life and Legacy of Edward Hitchcock* (Williamsburg, MA: Unquomonk Press, 2021) and Jordan D. Marché II, *Ambition's Triumph: The Rise of Massachusetts Geologist Edward Hitchcock* (Oregon, WI: Oramel Press, 2023).

[5] George Sheldon, *History of Deerfield, Massachusetts Vol. 2* (Deerfield, MA: George Sheldon, 1896), 845–48. According to Sheldon, Hitchcock's 12 predecessors were graduates of Yale (5), Dartmouth (5), Williams (1), and Harvard (1).

converting her friend to Calvinism. In his private notes of some twenty years later he wrote, "It was [Orra's] conversion and subsequent consistent conduct that first disarmed my skepticism and was a powerful means of leading me to embrace the same precious faith and hopes."[6] That shared faith became central to the couple's relationship and to their future together.[7]

During that time, Hitchcock also began work on his first major scientific investigation, a detailed study of the geology of the upper Connecticut River Valley in Massachusetts and adjacent Vermont and New Hampshire. He traveled up and down the valley, collecting specimens, recording his observations of the major rock formations, and drawing maps and cross-sections of the strata he observed.

In summer 1817 he began exchanging letters with Professor Benjamin Silliman (1779–1864) of Yale College, one of the most eminent American scientists of that time. Their first two exchanges pertained to mineral specimens Hitchcock had sent Silliman for identification.[8] But in a letter dated September 1, 1817, he informed the professor of his geological study and asked if he would be willing to read a draft.[9] Silliman quickly consented and soon received the manuscript.

Hitchcock's article was entitled "Remarks on the Geology and Mineralogy of a section of Massachusetts, on Connecticut river, with a part of New-Hampshire and Vermont."[10] It described the major features of the region including three geological formations—primitive rocks, secondary rocks, and alluvium—and noted localities of close to fifty minerals ranging from amethyst, garnet, and quartz to asbestos, talc, and titanium. It included a large (18" x 8") hand-colored map of the study area drawn by Orra White, the first of hundreds of her drawings, woodcuts, and paintings that would appear in his publications over the next three decades.

[6] Private Notes, March 30, 1840, Series 7-C, Edward and Orra White Hitchcock Collection, Box 19, Folder 3, Amherst College Archives and Special Collections (hereafter "EOH").

[7] Robert L. Herbert and Daria D'Orienzo, *Orra White Hitchcock: An Amherst Woman of Art and Science* (Amherst, MA: Amherst College, 2011).

[8] BS to EH, August 24, 1817, EOH, Box 3, Folder 37, and EH to BS, September 1, 1817, EOH, Box 5, Folder 12, BS to Benjamin Silliman, and EH to Edward Hitchcock. For transcriptions of most of the letters between Silliman and Hitchcock cited below see Robert L. Herbert, "The Complete Correspondence of Edward Hitchcock and Benjamin Silliman, 1817–1863," Amherst College Archives and Special Collections, http://bit.ly/2m6vnxtHitch, accessed May 28, 2025.

[9] EH to BS, September 1, 1817, EOH, Box 5, Folder 12.

[10] Edward Hitchcock, "Remarks on the Geology and Mineralogy of a Section of Massachusetts, on Connecticut River, with a Part of New-Hampshire and Vermont," *AJS* 1, no. 2 (1818): 105–16 and *AJS* 1, no. 4 (1818): 436–39.

Hitchcock made one observation in that article whose significance neither he nor any American geologist could have anticipated:

> In the town of Gill [Massachusetts] . . . there is a cataract in Connecticut river, from 30 to 40 feet in height; and it is believed that the alluvial region, and part of the secondary shown on the map from this fall to the place where the river passes between mount Holyoke and Tom, was formerly the bed of a lake . . . South of these hills commences another alluvial and secondary tract, extending on both sides of the river to Haddam, in Connecticut, where the river passed between mountains, and perhaps this region also was the bed of a lake.[11]

Many decades would pass before those ancient lakes would emerge as part of a revolutionary new view of the forces that shaped the earth's surface.

Silliman replied to his young protégé a few weeks later: "I am exceedingly gratified by your geological maps & dissertation. They are very creditable both to your industry & discrimination & are particularly interesting to me."[12] He then reported on a new development in American science, one that would become critical to the young man's career: "I would . . . mention to you in confidence that a project is in contemplation for the publication of a scientific journal to consist entirely of original American pieces . . . Should this thing be matured I expect to have something to do with it & should be very happy to have your work appear in the first No."[13] This was an offer the young man could not refuse. True to his word, Silliman included Hitchcock's article in the new *American Journal of Science* established by him at Yale, not in the first issue but as the lead article in the second issue published in late 1818. It was the first of more than sixty contributions Hitchcock made to that journal over the subsequent four and a half decades.[14]

Hitchcock's "Remarks" was about to go to press when, in early September 1818, he received some stunning news: Yale College had conferred upon him an honorary Master of Arts degree. He had never applied to Yale, never registered as an official student; his name had never appeared on any roster at that institution. Yet it seems he was now an honorary Eli. In his memoir published decades later, Silliman wrote of Edward Hitchcock, "His starting-point was with us, and we may regard him as a pupil of our scientific departments."[15]

[11] Ibid., 107.

[12] BS to EH, October 27, 1817, EOH, Box 3, Folder 37.

[13] Ibid.

[14] Robert T. McMaster, "Published Works of Edward Hitchcock," 2022, https://www.EdwardHitchcock.com/resources.html, accessed on June 25, 2025.

[15] George P. Fisher, *Life of Benjamin Silliman, M.D., LL. D*. Vol. 1. (New York, NY: Charles Scribner and Company, 1866), 303.

Edward Hitchcock at Yale

By autumn, 1818, Hitchcock had separated from Deerfield Academy. Whether he had resigned or was dismissed is not known, but his departure was probably due not to any shortcoming on his part but rather to the school's growing financial straits.[16] Seeking to pursue his dual interests in science and theology, he wrote Benjamin Silliman in January 1819: "Pray, sir, do the laws of your College permit access to your lectures to one who is not an alumnus of it?"[17] Silliman promptly consented, as did the famed Yale theologian, Reverend Eleazar Fitch (1791–1871). A few months later Hitchcock traveled to New Haven. He spent the better part of four months in that heady environment, returning at least a half dozen times over the next two years.

Even in 1819, Yale was a venerable institution more than a century old. Originally established for the training of young men for the Christian ministry, it was by that time far more than a school for religious education. Among its faculty could be found many of the foremost American scholars of the period in the classics, literature, humanities, sciences, and religion.

Yale was strongly Calvinist in the early nineteenth century, not surprising considering that its president, Timothy Dwight, was the grandson of Reverend Jonathan Edwards, a firebrand of American revivalism. In Silliman and Fitch, Hitchcock witnessed two approaches to the relationship between science and faith. Silliman was a pragmatic Christian who pursued his scientific interests without troubling himself with possible religious implications. Professor Fitch, on the other hand, was a strict Calvinist. But Fitch was also a biblical scholar who advocated for a careful, informed interpretation of Scripture, especially on such controversial subjects as original sin and infant damnation. Those two approaches to faith and knowledge went a long way to shape the world view of Edward Hitchcock the preacher and Edward Hitchcock the scientist.

Hitchcock made many acquaintances in New Haven and felt more at home there theologically than in Deerfield:

> I went to New Haven most resolutely opposed to Orthodox intolerance, and to certain doctrines which I supposed to belong to the Orthodox creed. Judge then of my agreeable surprise when I found that my views in all important

[16] Financial records of the Academy held at the Deerfield Memorial Libraries, Deerfield, MA, show that Hitchcock continued to receive payments from the Academy, apparently in arrears, for months after his departure. As a result of financial troubles, the school closed its doors temporarily in 1819.

[17] EH to BS, January 29, 1819, in Fisher, *Silliman* Vol. 2, 135.

> respects coincided with those of the Orthodox and my still greater surprise to find much less of intolerance and bigotry than among Unitarians.[18]

In June 1819, after attending Professor Fitch's lectures for less than a month, Hitchcock was invited to deliver a sermon at the West Haven Congregational Church. His notes from that occasion reveal a good deal about the young man's temperament:

> June 6th 1819. Conducted the services of God's house at West Haven for Mr. Stebbins . . . Felt much solicitude, diffidence and weakness in this first effort in the pulpit: but have much reason to be grateful that utterance was given me . . . [I] feel fearful that my lungs never will permit me to preach long should I live to complete my studies–but with God all things are possible. Let me be humble! Let me be watchful![19]

Hitchcock's lungs proved far more durable than he might have imagined. That sermon was the first of more than one thousand he would preach in the next forty-five years.[20]

Over the summer and autumn of 1819, Hitchcock made two excursions in the New Haven area, one to Lyme at the mouth of the Connecticut River for a religious convention, one across the sound to Long Island.[21] On several occasions Professor Silliman escorted him to some of the area's geological highlights, including one trip to Cheshire, about thirteen miles north of the city, and another to East Haven and Branford.[22] The idea for a study of the lower Connecticut Valley may well have had its genesis in this period.

That autumn Professor Silliman hosted a meeting at Yale of a group of scientists that came to be known as the American Geological Society. Present were some of the nation's most distinguished scientists including Parker Cleaveland, George Gibbs, Robert Hare, Stephen Elliott, and J.W. Webster. William Maclure, then President of the Academy of Natural Science in Philadelphia, was elected president of the new organization. Parker Cleaveland, professor of geology at Bowdoin College, and George Gibbs, a businessman

[18] Edward Hitchcock, "Private Notes," pp. 1–86, EOH, Series 7-C, Box 19, Folder 3, February 8, 1829. For a complete transcription of Hitchcock's private notes see https://www.EdwardHitchcock.com/transcriptions.html, accessed on June 25, 2025.

[19] "Notes," 1819, EOH, Box 18, Folder 1.

[20] For a list of Hitchcock's sermons compiled by the author including dates and locations see "Database of the Sermons of Edward Hitchcock" at https://www.EdwardHitchcock.com/resources.html.

[21] "Notes," 1819, EOH, Box 18, Folder 1.

[22] BS to EH, August 2, 1822, EOH, Box 3, Folder 38.

who had devoted himself to geological travels and investigations, were named Vice-Presidents of the Association.[23]

At Silliman's invitation Edward Hitchcock attended that first meeting and was appointed recording secretary of the new organization. Suddenly he found himself at the very epicenter of American geology. It was an ideal position in which to learn of the latest developments in the discipline and a potential springboard for a young geologist hoping to become established among the leaders in his field.

The Reverend Edward Hitchcock

When Hitchcock returned to Deerfield in late autumn, 1821, he had a new voice and a new vocation: he was now Edward Hitchcock, itinerant preacher. From January 1820 to May 1821, he traveled up and down the Connecticut River Valley, delivering over 100 sermons in the absence of church pastors. Most of his assignments were in Massachusetts although he preached over a dozen times in Brattleboro, Vermont, once in Saratoga, New York, and several times in Connecticut, including a harrowing mid-winter excursion to Waterbury.[24]

The one church to which Hitchcock was called most often in that period was the Congregational church in Conway, Massachusetts. Conway was a bustling agricultural and industrial center in the foothills of the Berkshires just a few miles west of Deerfield. Hitchcock had filled in at that pulpit on more than thirty Sabbaths when, in May 1821, the aging pastor announced his partial retirement. Not surprisingly, Hitchcock received the call. A few days later he and Orra White were married in Amherst, then relocated to Conway. On Friday, June 21, 1821, he was ordained in the Conway meetinghouse. Two days later Reverend Edward Hitchcock delivered the first two sermons in his new post.[25]

The new junior pastor had stipulated as a condition of his appointment in Conway that he be granted five weeks leave each year to pursue scientific interests. The wheels of his scientific curiosity were already spinning when, just two months into his new position, he wrote Benjamin Silliman with a proposition:

> I have Sir a proposal to make which perhaps you may deem chimerical or improper. It is that we should unite in forming a Geological map of the

[23] "American Geological Society," *AJS* 2, no. 1 (1820): 139–44.
[24] EH to Orra White, February 22, 1821, EOH, Series 2-B, Box 5, Folder 31.
[25] McMaster, *All the Light Here Comes from Above*, 2021, 73f.

> secondary region from N. Haven to Vermont. This is an interesting region and it appears to me a correct map with an accompanying memoir exhibiting the whole of this region at one view & describing minutely its geology & mineralogy must be serviceable to science . . . As to the execution of the map, the same person who made my former ones is now my colleague & will undertake again if wished.[26]

Most of the fieldwork required for this new project already had been accomplished as suggested by Hitchcock's words in that same letter: "I suppose you already have the south part of the secondary region ready for a map on the plan above mentioned. And probably the part that will need most examination is that between Hartford & Springfield."[27] Silliman penned a prompt and enthusiastic reply to the idea, but he had one reservation: "I like your plan for the report of the secondary region—it is what I have long wished & contemplated but am satisfied I can never do it. I shall be very much satisfied to have it in your hands. I may aid you somewhat at this end but can promise nothing owing to the precarious state of my health."[28]

Far from discouraged by his mentor's response, Hitchcock threw himself headlong into this new project. It encompassed four times the area of his earlier study and three times the number of rock formations. The few records of his travels over the next six months suggest that he made only one or two brief visits to New Haven. One trip that is documented took him from Conway to Suffield, Connecticut, but he may well have embarked upon several short excursions to northern Connecticut during that time to fill in some gaps in his knowledge of that area.[29]

Hitchcock's project came at a pivotal moment in the history of American geology. In the eighteenth and early nineteenth centuries geology was largely a European discipline. The foremost geologists of that time were Abraham Gottlob Werner (1749–1817), a German, and James Hutton (1726–1797), a Scotsman. They were brilliant men, but they saw the world through a European lens; neither ever traveled outside Europe.

By 1810, the first generation of American geologists had begun to rise to prominence. They were scientists familiar with the North American continent and devoted to expanding the understanding of its geological history. William Maclure, a native of Scotland, had moved to America in 1796. For several years he traveled across the nation, recording his observations of landforms

[26] EH to BS, August 6, 1821, EOH, Box 5, Folder 12. That "same person" was his wife, Orra.

[27] Ibid.

[28] BS to EH, August 11, 1821, EOH, Box 3, Folder 37.

[29] EH to BS, July 23, 1822, EOH, Box 5, Folder 12.

and rock types. In 1809 he published the first major treatise on the geology of the young nation including a hand-colored, highly generalized map of the major rock classes.[30] In 1816 Parker Cleaveland, a professor at Bowdoin College in Maine, published a book on mineralogy and geology accompanied by a geological map of America not unlike Maclure's.[31] Both works were important, but they painted the geology of the young nation with a broad brush. Maclure made only four references to Connecticut's geology, and his map showed only three rock classes in the state: primitive, transition, and secondary. Cleaveland's book dealt largely with locations of minerals, sometimes with reference to the rock formations in which they were found; his map showed only two rock classes in Connecticut, primitive and secondary.

Between 1810 and 1822, four native sons of the northeastern United States published studies of the geology of Connecticut. Benjamin Silliman, while best known as a chemist, wrote three articles on the state's geology; the third and longest, "Sketches of a tour in the counties of New-Haven and Litchfield in Connecticut, with notices of the Geology, Mineralogy and Scenery, etc.," proved particularly useful to Hitchcock.[32] In 1818 Amos Eaton, an eminent New York geologist and botanist trained at Williams College and Yale, published *An Index of the Geology of the Northern States*. While that work did not include a map, it did feature a large, detailed east-west cross-section through Massachusetts showing the relative positions of sixteen rock formations.[33] In 1819 John Pierce Brace, a Connecticut native and graduate of Williams College, published an article describing the minerals of Litchfield County.[34] It too included no map, but it provided Hitchcock with valuable mineralogical information on western Connecticut. Hitchcock cited Silliman, Eaton, and Brace over 100 times in his published article.

[30] William Maclure, "Observations on the Geology of the United States, explanatory of a Geological Map," *Transactions of the American Philosophical Society* 6, Part 2 (1809): 411–28; "Observations on the Geology of the United States of North America," *Transactions of the American Philosophical Society* New Series 1, no. 1 (1818): 1–91.

[31] Parker Cleaveland, *An Elementary Treatise on Mineralogy and Geology, Etc. With a Map of the United States* (Boston, MA: Cummings & Hilliard, 1816).

[32] Benjamin Silliman, "Sketch of the Mineralogy of the Town of New-Haven," *Memoirs of the Connecticut Academy of Arts and Sciences* 1, Part 1 (1810): 83–96; "Mineralogical and Geological observations on New-Haven and its vicinity," *American Mineralogical Journal* 1 (1814): 139–49; and "Sketches of a tour in the counties of New-Haven and Litchfield in Connecticut," *AJS* 2, no. 2 (1820): 201–35.

[33] Amos Eaton, *An Index to the Geology of the Northern States* (Leicester, MA: H. Brown, 1818).

[34] John P. Brace, "Observations on the Minerals connected with the Gneiss range of Litchfield county," *AJS* 1, no. 4 (1819): 351–55.

During the winter of 1821–1822, Reverend Hitchcock stayed close to home, ministering to his flock, reading the latest geological literature, and writing the extensive narrative for his article. While he lived in rural western Massachusetts far from any major academic library, he nevertheless managed to keep abreast of the latest thinking in geology, thanks in large part to Benjamin Silliman who regularly posted new books and journals to his protégé. For her part Orra was also busy, but with preparations of an entirely different sort, the impending birth of the couple's first child. Little Edward was born in May 1822. Nevertheless, she found time during that same period to complete the first draft of the geological map that would accompany her husband's new manuscript.

In early July Hitchcock sent Silliman a draft of the Connecticut portion of that map with the major rock formations hand painted in bold, vibrant colors. A few days later Silliman replied with many suggestions such as the following: "The primitive trap [of New Haven] is carried too far W[est] . . . The coal formation is distinct, very distinct W of Middletown & so on down to Durham & as high up as opposite Berlin East . . . I think you have omitted Mt. Carmel [also known as Sleeping Giant], that remarkable knob."[35]

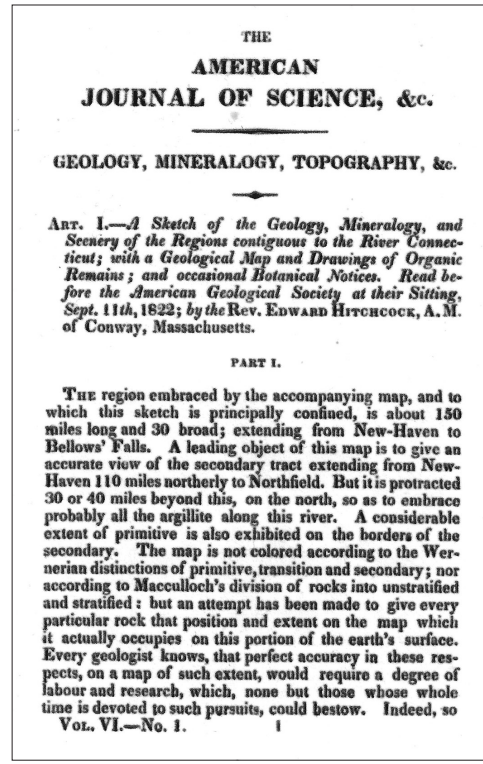
Silliman also shared Hitchcock's map with another Connecticut geologist, James G. Percival (1795–1856). Though best known for his poetry, Dr. Percival was well-versed in the geology of his home state, having studied with Silliman at Yale. He too made many comments on the draft map that Silliman relayed to Hitchcock. Percival also drew a sketch detailing the extent of the greenstone formation in the vicinity of Lake Saltonstall in East Haven and Branford.[36]

In that same letter Professor Silliman revealed his two-part plan for Hitchcock's new treatise. It would appear in the next volume of his journal, but in addition he wanted Hitchcock to deliver a discourse on the subject at Yale. Commencement was scheduled to take place in just over a month, and on that same day the third annual meeting of the American Geological Society was to convene. Silliman wrote, "I hope you will be ready by commencement & if I can aid you any farther pray write."[37] Whether Hitchcock harbored any anxiety at the approach of that occasion we do not know. By this time it seems clear that he was well over his former fears of his lungs failing him.

[35] BS to EH, August 2, 1822, EOH, Box 3, Folder 38; includes the hand-colored draft map.

[36] Ibid.; includes Percival's sketch.

[37] Ibid.



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GEOLOGY, MINERALOGY, TOPOGRAPHY, &c.

ART. I.—*A Sketch of the Geology, Mineralogy, and Scenery of the Regions contiguous to the River Connecticut; with a Geological Map and Drawings of Organic Remains; and occasional Botanical Notices. Read before the American Geological Society at their Sitting, Sept. 11th, 1822; by the* REV. EDWARD HITCHCOCK, A. M. of Conway, Massachusetts.

PART I.

THE region embraced by the accompanying map, and to which this sketch is principally confined, is about 150 miles long and 30 broad; extending from New-Haven to Bellows' Falls. A leading object of this map is to give an accurate view of the secondary tract extending from New-Haven 110 miles northerly to Northfield. But it is protracted 30 or 40 miles beyond this, on the north, so as to embrace probably all the argillite along this river. A considerable extent of primitive is also exhibited on the borders of the secondary. The map is not colored according to the Wernerian distinctions of primitive, transition and secondary; nor according to Macculloch's division of rocks into unstratified and stratified: but an attempt has been made to give every particular rock that position and extent on the map which it actually occupies on this portion of the earth's surface. Every geologist knows, that perfect accuracy in these respects, on a map of such extent, would require a degree of labour and research, which, none but those whose whole time is devoted to such pursuits, could bestow. Indeed, so

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Figure 3. Source: Edward Hitchcock, "Sketch of the Geology, Mineralogy, and Scenery of the Regions contiguous to the River Connecticut," *AJS* 6, no. 1 (1823): 1.

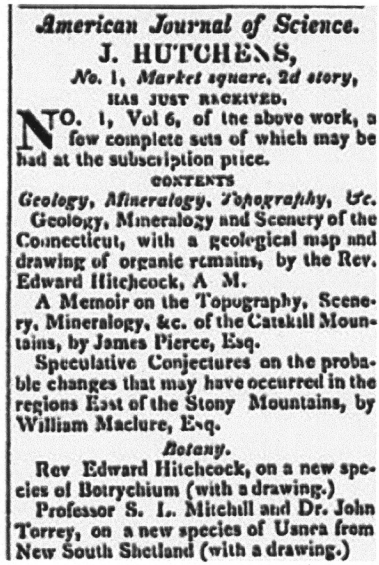
HITCHCOCK'S "SKETCH"

As planned, Hitchcock delivered his discourse before the American Geological Society in the newly completed Gibbs Mineralogical Cabinet at Yale on Commencement Day, September 11, 1822. Four months later, the first of three installments of his article appeared in the *American Journal of Science*. Entitled "A Sketch of the Geology, Mineralogy, and Scenery of the Regions Contiguous to the River Connecticut," it was far from a "sketch" in the present-day sense of that term, spanning 136 pages in three issues, by far the longest article yet to appear in that journal.[38]

Perhaps sensing that his article might interest a wider audience, Hitchcock wrote Silliman:

> Would not a few copies of the proposed sketch if bound separate from the Journal with a title page sell at the bookstores? I want your advice (if it will not interfere with the Journal) whether I had better employ the printers to

[38] Hitchcock, *AJS* 6 and 7, 1823.



American Journal of Science.
J. HUTCHENS,
No. 1, Market square, 2d story,
HAS JUST RECEIVED,
NO. 1, Vol 6, of the above work, a few complete sets of which may be had at the subscription price.
CONTENTS
Geology, Mineralogy, Topography, &c.
Geology, Mineralogy and Scenery of the Connecticut, with a geological map and drawing of organic remains, by the Rev. Edward Hitchcock, A M.
A Memoir on the Topography, Scenery, Mineralogy, &c. of the Catskill Mountains, by James Pierce, Esq.
Speculative Conjectures on the probable changes that may have occurred in the regions East of the Stony Mountains, by William Maclure, Esq.
Botany.
Rev Edward Hitchcock, on a new species of Botrychium (with a drawing.)
Professor S. L. Mitchill and Dr. John Torrey, on a new species of Usnea from New South Shetland (with a drawing.)

Figure 4. Advertisement. Source: *Providence Gazette*, February 26, 1823.

> strike me off say 100 additional copies. I should like to have a few copies scattered along the river to excite a spirit of enquiry: but if there is little probability of disposing of them I had better save my money & my credit.[39]

Silliman was agreeable but suggested printing only sixty copies. Advertisements for volume 6 of the *AJS* with his article mentioned prominently appeared in newspapers in New Haven, Providence, Boston, Springfield, Northampton, and Columbia, South Carolina.

Hitchcock's treatise was divided into three parts: I., Rock Formations, II., Simple Minerals, and III., Scenery. Accompanying the article was a large (21" x 9") geological map drawn by Orra White Hitchcock with two cross-sections in the margins, four illustrations, a table of rock types, and several postscripts added following Part III. The format was one he would employ again in his geological survey reports of Massachusetts (1833 and 1841) and Vermont (1861).[40]

[39] EH to BS, September 22, 1822, EOH, Box 5, Folder 12.

[40] Edward Hitchcock, *Report on the Geology, Mineralogy, Botany, and Zoology of Massachusetts* (Amherst, MA, J. S. and C. Adams, 1833); Edward Hitchcock, *Final Report on the Geology of Massachusetts* (Amherst, MA: J. S. and C. Adams, 1841); Edward Hitchcock, Albert D. Hager, Edward Hitchcock, Jr., and Charles H. Hitchcock, *Report on the Geology of Vermont*, 2 vols. (Claremont, NH: Claremont Manufacturing Co., 1861).

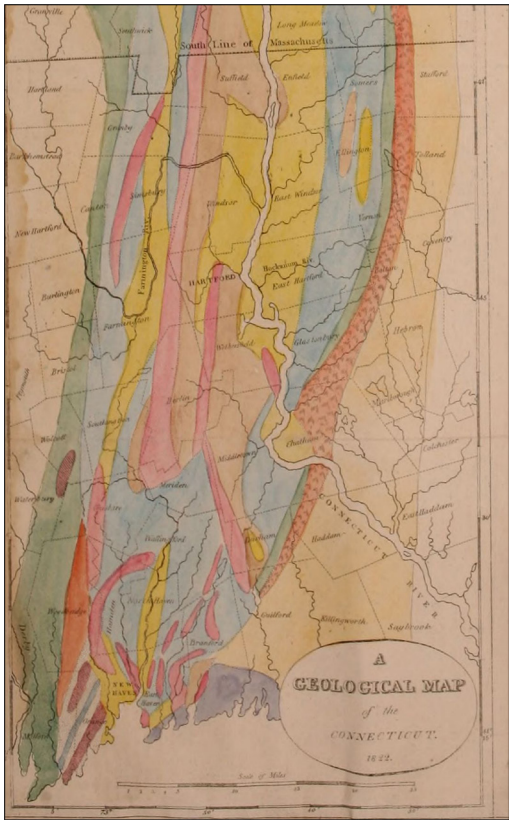


Figure 5a. "A Geological Map of the Connecticut, 1822." Source: Edward Hitchcock, "Sketch of the Geology, Mineralogy, and Scenery of the Regions contiguous to the River Connecticut," *AJS* 6, no. 1 (1823).

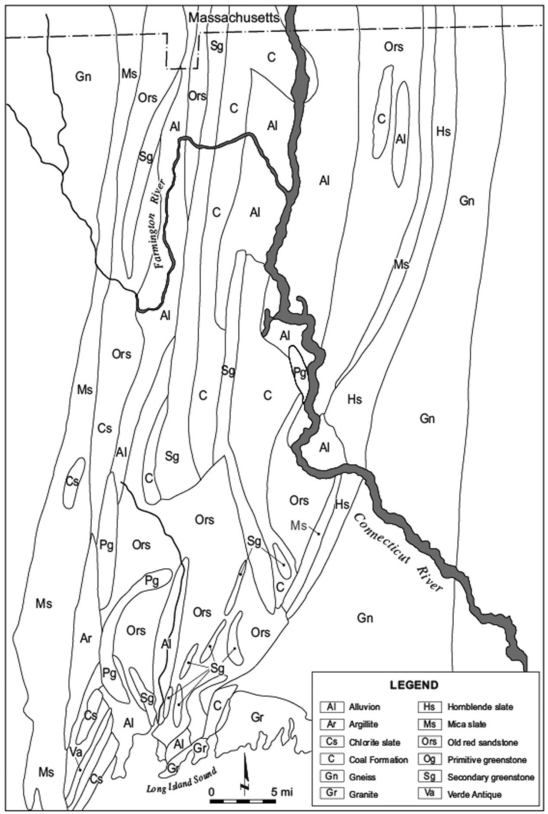


Figure 5b. The Connecticut portion of Hitchcock's geological map with the major rock formations labeled. Source: Edward Hitchcock, "Sketch of the Geology, Mineralogy, and Scenery of the Regions contiguous to the River Connecticut," AJS 6, no. 1 (1823).

I. Rock Formations

Hitchcock identified sixteen rock formations in the study area employing a new system of nomenclature introduced only months earlier by the British geologists William D. Conybeare and William Phillips.[41] He appended a three-page "Tabular Arrangement of the Rock Formations Along the Connecticut" based on that system with this comment: "I here follow with pleasure the very simple yet ingenious arrangement of rocks, which is adopted by Conybeare and Phillips, as the basis of their recent work on the Geology of England and Wales. It has the rare merit of being entirely free from hypothesis."[42] In other words, explained Hitchcock, the arrangement of rock formations that followed was not intended to be chronological. The rock formations he found in Connecticut are described below in the order in which he presented them.

GRANITE. Hitchcock described the granite of the study area as a primitive rock containing feldspar, quartz, and mica. He noted that it was highly variable, exhibiting nearly all the forms found elsewhere in the world, its texture ranging from fine- to coarse-grained with particles colored from white to red to light blue to dark blue to black.[43] While sometimes occurring in beds between overlying sedimentary rock, granite was generally the lowest layer of rock in the entire region, "probably form[ing] the basis rock in New-England."[44] He noted, "The granite along the Connecticut appears much lower than the neighbouring rocks, such as gneiss and mica slate. No person who examines the East-Haven granite, or that running through the Leveret [MA], or even the South Hampton [MA] deposit, will doubt that some powerful agent has swept away an immense mass of superincumbent rocks of some description or other."[45]

The only extensive exposure of granite observed by Hitchcock in the Connecticut portion of the study was a small area stretching from New Haven eastward to Branford, with its southwest extremity at the Five Mile Point Lighthouse in a section of New Haven that in Hitchcock's day was part of East Haven. Where granite lay exposed at the surface, Hitchcock argued that the overlying formations had been eroded away, although he later

[41] William D. Conybeare and William Philips, *Outline of the Geology of England and Wales* (London, UK: William Phillips, 1822).

[42] Hitchcock, "Sketch," *AJS* 7 (1823): 24–7.

[43] Hitchcock, "Sketch," *AJS* 6, 10.

[44] Hitchcock, "Sketch," *AJS* 6, 4.

[45] Ibid., 11.

mentioned beds of granite occurring in gneiss at Chatham and Haddam where it contained veins of other minerals including beryls and tourmalines.[46] He also mentioned the presence of granite outside the study area in Litchfield County.[47]

In Woodbridge he observed numerous boulders of what he termed "elegantly porphyritic granite" containing large crystals of feldspar, often perfectly square and as long as two inches. He was unable to determine the origin of those boulders.[48] Although Hitchcock did not describe the uses of granite, it was at that time the most desirable stone for construction. Many buildings erected in his day are still standing today.[49]

GNEISS. According to Hitchcock, gneiss was a primitive rock similar in composition to granite but often somewhat stratified, frequently grading into mica slate and a darker, denser rock known as hornblende slate. Wrote Hitchcock, "This mixture of gneiss with other rocks, and the consequent indistinctness of character, render it, in some instances, not very easy to give its limits."[50] He took particular note of this difficulty on the west side of the study area in Bristol, Canton, and Plymouth, Connecticut. On the east side of the Connecticut River, mica was the main constituent with layers typically dipping to the east between twenty and ninety degrees.[51],[52] He also mentioned that the gneiss of Haddam contained veins of granite.[53]

Hitchcock reported that while gneiss was the most abundant rock in New England, it was not abundant in the Connecticut River Valley, becoming much more common to the east and west of the study area.[54] In his time gneiss was used often in construction due in part to the very large stones that could be excavated, prompting this uncharacteristically droll comment: "Immense tables of it may be procured, and should the mania for constructing pyramids ever seize the inhabitants of New-England, this gneiss might produce masses of stone rivaling in magnitude the immense limestone blocks of the pyramids of Egypt."[55]

[46] Ibid., 5–6.
[47] Ibid., 5.
[48] Ibid., 17.
[49] https://quarriesandbeyond.org/states/cn/cn-structures.html, accessed June 21, 2025.
[50] Hitchcock, "Sketch," *AJS* 6, 19.
[51] Ibid., 20.
[52] Ibid., 17.
[53] Ibid., 19.
[54] Ibid., 18.
[55] Ibid., 19.

SLATE. Hitchcock found three variations of slate in Connecticut: hornblende, mica slate, and chlorite slate. According to his map, slate constituted about twenty-five percent of the Connecticut portion of the study area.

HORNBLENDE SLATE. He began his discussion of hornblende slate with this admission: "This is an anomalous and perplexing rock. It is not generally well characterised in this region: but I have put it down, because a rock approaching nearer the characters of this than of any other, occurs in considerable abundance along the Connecticut—I have no confidence however that I have given in all cases its exact situation or extent. Yet I believe that wherever this stratum is coloured on the map, the rocks may be found in the vicinity."[56]

Hornblende slate contained a mixture of hornblende, quartz, mica, and slate in varying proportions. He described it as "schistose" (i.e., layered) with layers ranging in thickness from 0.5 to 3 inches. He often found hornblende slate in contact with gneiss and suggested that it could easily be confused with gneiss or even be considered a form of gneiss. It was often porphyritic, containing large crystals of quartz or feldspar as seen particularly in Chatham.[57]

He made this interesting note about hornblende slate: "Good examples of the rock containing quartz and some mica may be seen in the flagging stone of the side walks along the eastern side of the Public Square in New-Haven, and in other parts of that city."[58]

MICA SLATE. "This rock is somewhat Protean in its appearance," wrote Hitchcock. He then described a dozen variations found in the study area with different proportions of mica, quartz, sand, and feldspar. He found mica slate far more abundant to the north of the study area than to the south, often in contact with granite or gneiss. In Connecticut he reported a narrow band on the east side of the study area ranging from Bolton northward.[59]

CHLORITE SLATE. Hitchcock found chlorite slate, a stratified rock containing the green mineral chlorite, in only two locations in the study area, one in southern Vermont and one extending from Milford to Oxford, Connecticut. He described the variety in West Haven as "extremely tortuous and undulating" and crisscrossed by seams of quartz. It often alternated with greenstone slate and mica slate. Near New Haven he observed crystals of iron ore in this rock which, when eroded by ocean waves, released reddish particles into the sea forming what he termed "iron sand."[60]

[56] Ibid., 20.
[57] Ibid., 20.
[58] Ibid., 22.
[59] Ibid., 23–24.
[60] Ibid., 27.

GREENSTONE. The most distinctive geological feature of the lower Connecticut River Valley described by Hitchcock was a series of imposing ridges composed largely of a dense rock known today as basalt. In his article he termed it greenstone, a reference to the greenish tinge observed in freshly broken rock, although he noted that weathered greenstone often bore a reddish-brown color.[61] He identified two types of greenstone in the study area, primitive and secondary. Primitive greenstone, fine-grained and unstratified, often underlay all the secondary formations in the valley. Where it intruded into the overlying stratified rock as vertical dikes and horizontal beds, he termed it secondary greenstone. Secondary greenstone differed from primitive greenstone in several important respects: it was often coarse-grained, usually stratified, and bore many mineral-lined cavities known as amygdaloids.[62]

The greenstone formation extended southward from the towns of Gill and Northfield in northern Massachusetts, reaching its southernmost limit in a bluff approximately 1.5 miles north of the East Haven Lighthouse, probably in the vicinity of Fort Nathan Hale.[63] It included nearly all the region's highest mountains—the Pocumtuck Range and Mounts Toby, Holyoke, and Tom in Massachusetts, Talcott Mountain, the Hanging Hills, Higby Mountain, the Sleeping Giant, and East and West Rocks in Connecticut—eminences that rose above the adjacent lowlands from a few hundred feet to over 1000 feet. According to his map the greenstone formation covered about ten percent of the study area in Connecticut.

Hitchcock became familiar with this formation at an early age. From his childhood home in Deerfield, Massachusetts, he could look up at the cliffs of the Pocumtuck Range (then known as Deerfield Mountain) that loomed above the village. It made quite an impression on the young boy as suggested by a paragraph from his 1823 article:

> To give the ranges of this rock was one of the principal objects in constructing the accompanying map. For although it is anomalous, it is a highly interesting formation. The high mural precipices that almost universally show their naked faces in the ridges and hillocks of this rock—the immense quantity of debris that frequently slope up half, or two thirds the distance to their summits—and the thin tufts of trees that crown their tops, form much of the peculiar scenery of the Connecticut. They remind the European of the basaltic and other trap ridges of Scotland, Ireland, Saxony, Auvergne, Italy, etc.[64]

[61] Ibid., 53. In a brief notice written by Hitchcock in 1815, "Basaltick Columns," *North American Review* 1, no. 3: 337–38, he referred to this rock as basalt.

[62] Ibid., 51.

[63] Hitchcock, "Sketch," *AJS* 6, 44.

[64] Ibid.

According to Hitchcock, greenstone was formed from superheated molten rock at some time in the earth's past, then cooled and solidified (today it is termed "igneous," a word Hitchcock did not use). The origin of the oldest rocks in the earth's crust had been the subject of a longstanding dispute in eighteenth- and nineteenth-century geology. Werner argued that those rocks were formed in water, while Hutton favored a volcanic origin. Based on his observations of the Connecticut River Valley, Hitchcock came down on the side of Hutton. He was strongly influenced on that question by a recent work of Thomas Cooper, geologist and president of South Carolina College, writing: "To President Cooper, especially, who regards the greenstone of the Connecticut as volcanic, I feel much indebted for the great mass of facts he has collected on the subject. And were I to adopt any hypothesis in regard to the origin of our greenstone, it would be one not much different from his."[65]

One characteristic of greenstone that Hitchcock observed will be familiar to anyone who has explored those ridges:

> The columnar tendency of our greenstone has often been noticed. It may be seen in almost every ridge in a greater or less degree, on the mural face—and these columns are sometimes remarkably regular. Good examples of them occur on the South-West face of Mount Holyoke; and still better ones a mile east of the village of Deerfield . . . They have from three to six sides, are articulated, the points varying from one to three feet in diameter, and of the same height, exhibiting handsome convexities and corresponding concavities.[66]

He noted that repeated freezing and thawing frequently fractured those columns, releasing segments that fell and accumulated at the base of the structure. When a segment dropped onto the pile of accumulated rocks or a walker stepped on that material, it produced a sharp metallic sound; in fact, another name for this rock in Hitchcock's day was "clinkstone."

In 1833 Hitchcock wrote of greenstone, "This is one of the most enduring of all rocks, but it is usually so much divided by irregular seams, into small and shapeless blocks that it is but little employed, either in the construction of houses, or walls."[67] How surprised he would be to learn that by the mid-twentieth century crushed greenstone, often termed traprock, was widely used as a base material in road and railroad construction and as a component of asphalt and concrete. In fact traprock today is the most valuable mineral resource in both Massachusetts and Connecticut, far more valuable than the granite and limestone mined as dimension stone for building construction

[65] Ibid., 60.
[66] Ibid., 53.
[67] Edward Hitchcock, *Report*, 1833, 20.

in his day or today. In 2019 about 6.2 million metric tons of trap rock were extracted in Connecticut with an estimated value of $80 million, about 5.4 million metric tons in Massachusetts with an estimated value of $73 million.[68]

LIMESTONE. Limestone is a sedimentary rock deposited on the beds of ancient lakes or seas. Hitchcock found very little limestone in the Connecticut River Valley of Connecticut but observed some to the west of the study area, most often adjacent to and sometimes mixed with mica slate. He cited three constituents of this limestone, carbonate of lime, mica slate, and silex (silica or silicate), with mica slate predominating. Limestone occurred in unstratified beds a few inches to twenty feet thick. He described this rock as suitable for "underpinnings" (i.e., foundations).[69] More extensive formations of higher quality limestone and marble, metamorphosed limestone, could be found beyond Hitchcock's study area in the northwestern corner of Connecticut as reported by John P. Brace.[70]

VERD ANTIQUE. Verd antique is a variety of marble characterized by veins and mottling of serpentine lending it a beautiful green color. Hitchcock found this rock in only one location in the study area, a narrow band beginning in Milford near the sound and extending northward about ten miles. Of this small formation he wrote,

> The rich and elegant marble obtained from this rock has induced me to give it a place on the map, although its extent is very limited. . . .[71] It is stratified. . . . the grain is fine; the rock is traversed by veins of calcareous spar, magnesian carbonate of lime, and asbestus; and is associated with chromate of iron and magnetic oxide of iron, diffused, more or less, through the entire body of the marble, and forming dark spots and clouds. The serpentine is twisted and entangled in the limestone in almost every form, and the green color of the rock may in general be imputed to oxid of chrome—sometimes to the presence of serpentine, colored however, probably by the same oxid.[72]

He reported on two quarries, one in Milford and one west of New Haven, noting that, "From these are obtained a marble which vies for elegance with any

[68] 2019 *Minerals Yearbook*, United States Geological Survey, Washington, DC, https://pubs.usgs.gov/myb/vol1/2019/myb1–2019-stone-crushed.pdf, accessed on June 20, 2025.

[69] Hitchcock, "Sketch," *AJS* 6, 37–38.

[70] Brace, "Observations," 1819.

[71] Hitchcock, "Sketch," *AJS* 6, 38.

[72] Ibid., 38–39.

in the world."[73] So beautiful was the rock from those quarries that it found its way into elegant homes in New Haven as well as the Smithsonian, the U.S. Capitol Building, and the East Room of the White House in Washington D.C.[74]

The quantity of this high-quality rock was limited, the quarrying process difficult and costly. Wrote Hitchcock, "[I]t is earnestly hoped that the patrician part of our community will not, by resorting to Europe for marbles, which, to say the least, are no more elegant than this, compel the proprietors of these quarries to abandon the undertaking."[75] His concerns proved justified; quarrying of verd antique in Connecticut was abandoned in the 1840s.

OLD RED SANDSTONE. Lying atop the primitive greenstone Hitchcock frequently observed what he termed old red sandstone, a sedimentary rock deposited on the beds of ancient rivers. Geologists in Europe had at that time described two red sandstone formations which they named old and new based on their relative positions.[76] In England and Wales coal lay between those two strata. So when Hitchcock found the red sandstone of the study area just above the primitive greenstone, he concluded that it must be the same as the "old red sandstone" of Europe. He found strata resting on top of that old red sandstone that looked something like coal, hence the designation "coal formations." But a decade later, he altered that opinion, referring to all the sandstone of the Connecticut Valley as "new red sandstone" based on the presence of vertebrate remains in the valley.[77]

Hitchcock described the sandstone as containing coarse grains cemented by iron-rich clay lending it a reddish or dark gray color. He often mentioned the smell of such sediments, writing of the red sandstone that ". . . the rock usually exhales an argillaceous [clay-like] odour when breathed upon."[78] Often the sandstone graded into a conglomerate consisting of pebbles of

[73] Ibid., 39.

[74] Charles R. Harte, "Connecticut's Minor Metals and Her Minerals Part 2," in *60th Annual Meeting of the Connecticut Society of Civil Engineers, Inc., at Hartford, March 22, 1944* (Hartford, CT: Connecticut Society of Civil Engineers, 1944), 32.

[75] Hitchcock, "Sketch," *AJS* 6, 39.

[76] The terms "old red sandstone" and "new red sandstone" were first employed by British geologist William Phillips in *The Geology of England and Wales* (London, UK: William Phillips, 1818) and later elaborated by Robert Jameson in *Manual of Mineralogy* (Edinburgh, UK: Archibald Constable & Co., 1821), 383, 391.

[77] Hitchcock, *Report*, 207–208.

[78] Hitchcock, "Sketch," *AJS* 6, 40.

quartz, feldspar, granite, and mica, in the same clayey matrix, the pebbles varying in size "from that of a musket ball to four or five inches in diameter."[79]

Of the red sandstone he noted, "It is probably the oldest secondary rock in this region, and generally lies beneath all the rest."[80] Red sandstone covered most of the valley in Connecticut, the sediments that once rested upon it having been removed by erosion. In several large areas he noted that red sandstone was covered by alluvium, often with the same distinctive reddish tinge as the rock below from which it was derived. In Massachusetts this rock rose to considerable height, especially at Mount Sugarloaf in Deerfield, where it lay at a steep angle against the greenstone. According to his map old red sandstone was the most abundant rock formation in the Connecticut part of the study area, covering about twenty percent of that area.

Hitchcock noted only a few examples of organic remains in the sandstone including an unidentified plant fossil and several pieces of lignite. He also reported on some animal bones discovered in this rock at Ketch's Mills in East Windsor.[81]

Secondary greenstone often occurred as dikes in the overlying sandstone. These structures he concluded had been extruded from the primitive layer while molten, pushed up through and often spread over the sandstone, forming a common sequence: primitive greenstone below, then red sandstone, with secondary sandstone above. Here he mentioned one of his field excursions, perhaps in 1822, with Benjamin Silliman: "Professor Silliman conducted me to an interesting locality of these [cracks and dikes] in East-Haven. They occur on the main road from New-Haven to East-Haven, less than half a mile from Tomlinson's bridge."[82] A cross-section at that East Haven location accompanying his geological map showed a series of seven greenstone dikes in red sandstone in just one-tenth mile.

Hitchcock noted that red sandstone was widely used for construction in his day: "This rock is extensively quarried for the purpose of building, in almost every town along the river. Noble specimens may be seen in the vestibules of the churches in New-Haven."[83] He took particular note of a variety of this rock found from Ludlow and Longmeadow, Massachusetts, to Somers, Ellington, and Enfield, Connecticut: "It forms a neater and handsomer building stone than any other rock of the sandstone family which I have ever

[79] Ibid., 40–41.
[80] Ibid., 39–40.
[81] Ibid., 43.
[82] Ibid., 56.
[83] Ibid., 42.

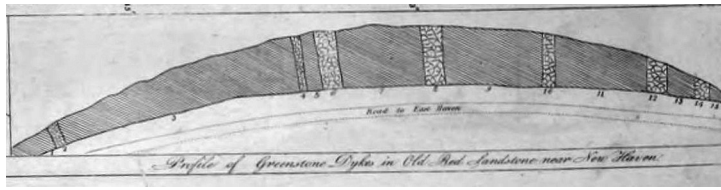


Figure 6. "Profile of Greenstone Dykes in Old Red Sandstone near New Haven." Old red sandstone is shown in gray, greenstone dikes in honeycomb pattern. Source: Edward Hitchcock, "Sketch of the Geology, Mineralogy, and Scenery of the Regions contiguous to the River Connecticut," *AJS* 6, no. 1 (1823).

seen."[84] Hitchcock is here referring to what is known today as "brownstone," although he never used that term. Brownstone was a variety of red sandstone quarried at several locations in Connecticut from East Haven to Middletown to Manchester. During the nineteenth century stone from those quarries was in great demand for construction, particularly in New York City.

More than a decade after the publication of "Sketch," Hitchcock received a report from Dr. James Deane of bird-like tracks embedded in slabs of red sandstone quarried near Greenfield, Massachusetts. Upon examining those slabs, Hitchcock concluded that the markings were indeed the tracks ("he called them fossil footmarks") of ancient birds or bird-like animals.

Over the next two decades he visited more than a dozen track localities in red sandstone, both in Massachusetts and Connecticut. In the twenty scholarly articles he published on the subject, he repeatedly argued for the avian origin of the tracks, basing that opinion on detailed observations of the outlines of the feet, toe number and position, gait, presence of scales and feathers, social behaviors, and the environment of those creatures. Scientists of his time generally agreed with Hitchcock's conclusion that those were the tracks of ancient birds or bird-like creatures. But he came in for a good deal of ridicule in the popular press of his day, especially about the notion of giant ancient birds walking the surface of the earth.

Hitchcock never used the term "dinosaur" to describe the makers of his fossil footmarks and for good reason: the term had not even been coined when he began his track research. When the British paleontologist Sir Richard Owen first used *Dinosauria* in 1842, he applied it to a group of four-legged reptiles found in the fossil record in England, creatures that could not possibly have made most of those tracks. Not until the 1860s was the term "dinosaur" expanded to include creatures such as Hitchcock's track-makers.

[84] Ibid., 41.

More than a century later, paleontologists reached the conclusion that modern-day birds are the descendants of a group of dinosaurs known as theropods of which most of Hitchcock's track-makers were members.[85] At last Edward Hitchcock's revolutionary views regarding those fossil footmarks were confirmed.

COAL FORMATIONS. In Hitchcock's day coal was believed to have been formed from plant matter subject to intense temperature and pressure over long periods of time. The term "coal formations" as used by Hitchcock and other contemporary geologists was not limited to coal per se but to any sedimentary rock that could potentially be a source of coal.[86] He wrote, "The coal formation embraces numerous varieties and sub-varieties of rocks, most of which alternate with one another."[87] He admitted that the terminology could be confusing, writing, "To denominate them the coal formation relieves, for a time, most of these difficulties: but that name will cheerfully be resigned whenever a more correct one shall be proposed."[88]

Among the principal coal formation rocks he observed in the study area were greenstone, shale, slate, several varieties of sandstone, graywacke, puddingstone, and limestone.[89] In Connecticut he found coal in East Haven, Southington, Berlin, Durham, Middletown, Chatham, Hartford, Wethersfield, Somers, Ellington, and Suffield.[90] While he noted that Connecticut coal was generally of good quality, the quantities he observed were very limited: "The seams of it are usually quite thin, rarely exceeding an inch in thickness, yet often they are numerous."[91]

He noted that the coal formations in the study area always lay above the red sandstone, although secondary greenstone could often be observed between the two.[92] "The suspicious circumstances attending them and the occurrence of the coal hitherto discovered in thin beds and veins only, render

[85] McMaster, *All the Light Here Comes from Above*, 179–88. Joanne Bourgeois, "Trackways in the New Red Sandstone of the Connecticut River Valley, USA, the cradle of ichnology," in *Geology's Significant Sites and their Contributions to Geoheritage* (London, UK: The Geological Society of London, 2023): 85–96.

[86] The term "coal formation" was also used by Maclure (1809, 1818) and Cleaveland (1822).

[87] Hitchcock, "Sketch," *AJS* 6, 61.

[88] Ibid., 76.

[89] Hitchcock, "Sketch," *AJS* 6, 61–62.

[90] Ibid., 63, 72–73.

[91] Ibid., 63.

[92] Ibid., 78.

it very doubtful whether extensive beds of this valuable mineral will ever be found in them."[93]

That prediction proved correct. Neither geologists nor prospectors ever found coal deposits of commercial value in Connecticut. Charles U. Shepard, who carried out the first comprehensive geological survey of the state in 1837, noted, "It is unnecessary to particularize the character of the numerous diggings which have been made in this [coal] formation, since they are all alike destitute of the indications essential for success; and I am happy to state, they are nearly or quite abandoned as hopeless, by all prudent persons."[94] Rhode Island had a successful coal mining industry for nearly a century; Bristol County in Massachusetts had a much smaller formation of marketable coal.[95]

Hitchcock reported very few organic remains in the coal formations of the study area. He found what he believed to be two species of ichthyolites (i.e., fossilized fish) in the Westfield section of Middletown, Connecticut. Similar fossils reported by Silliman from that location some eight years earlier were the first to be documented in North America. The illustrations of two fish fossils from Sunderland, Massachusetts, drawn by Orra were the first drawings of North American ichthyolites ever published.[96] He also found rhizolites (i.e., fossilized plant roots) in one location in Connecticut: "The longest specimen of rhizolite I have seen occurs on the road side, one half mile south of Newgate prison; being not less than seven or eight feet in length."[97]

ALLUVION. Hitchcock called surficial sediments deposited relatively recently by water "alluvion," known more commonly today as alluvium. He wrote, "By this term I understand those accumulations of gravel, clay, sand, mud and salt, which are post-diluvian, or have probably been deposited since the Noachic deluge [i.e., the Biblical flood] by causes at present acting on the globe."[98] Alluvion was highly stratified with gravel the bottom layer, coarse clays above the gravel, sand above the clays, loam and mud above the sand.[99] Alluvion on the coast was deposited by seawater and wind while inland it was deposited by running water. He noted that those deposits were often

[93] Ibid., 76.

[94] Charles U. Shepard, *A Report on the Geological Survey of Connecticut* (New Haven, CT: B.L. Hamlen, 1837), 62.

[95] McMaster, "Revelations in Stone: Edward Hitchcock and the Geology of Rhode Island," *Rhode Island History* 81, no. 2 (Fall 2024): 56–73."

[96] Arnaud Brignon, "The Earliest Discoveries of Articulated Fossil Fishes (Actinopterygii) in the United States: A Historical Perspective," *AJS* 317 (2017): 216–50.

[97] Hitchcock, "Sketch," *AJS* 6, 80.

[98] Ibid.

[99] Ibid., 81–82.

Figure 7. A fossilized fish (*Semionotus*) in red sandstone from Middletown, Connecticut. Courtesy of the Joe Webb Peoples Museum, Wesleyan University, Middletown, CT.

mixed with material eroded from the underlying rock at a location, sometimes resulting in distinctive soils: "The old red sandstone for instance, and the red slate of the coal formation, are very liable to decomposition, and thus a reddish soil is produced, so manifestly composed of the ruins of the rock, that one is able often to determine from the appearance of the soil at the distance of two or three miles the particular rock that lies beneath it."[100]

GEEST. Hitchcock referred to the final formation in the study area as geest, an assortment of pebbles, stones, and boulders of varying sizes and compositions. He wrote, "[E]very geologist knows that much deposition exists on the globe which no one refers to what is commonly understood by alluvion, and which could result from no processes nature is now carrying on. This is scattered over the most mountainous tracts, and in all cases of considerable extent, occupies at least three quarters of the surface."[101] There was one important difference between geest and alluvion—stratification. Alluvion was

[100] Ibid., 82.
[101] Hitchcock, "Sketch," *AJS* 7, 17.

stratified, suggesting deposition in water, geest was not, a point Hitchcock did not mention.

Hitchcock attributed deposits of geest to the Great Flood in the Book of Genesis, a flood that was said to have inundated the entire planet, destroying nearly all life and reworking the earth's surface. That mantle of geest was often referred to as "diluvium," meaning a result of that biblical flood. This was a notion that enjoyed wide acceptance among scientists in Europe and North America in that time. It later became known as the "diluvial hypothesis."

II. Simple Minerals

Hitchcock next listed the minerals identified by himself and several dozen other workers in the four states. Some entries were short, including only the town and source: "Ferruginous Quartz. At Litchfield. (Brace.)"[102] Others were much more detailed: "Amethyst. At Wallingford, Farmington, Berlin and East-Haven. Also at Mount Tom in East-Hampton (Silliman). Also in greenstone, Deerfield, forming geodes of a light purple; crystals from one tenth of an inch to an inch in diameter. Also in Westminster, Vermont, in crystals an inch and a half in diameter."[103] His list included more than 500 rock and mineral localities, some 200 of which occurred in fifty-two Connecticut towns and seven of the state's eight counties. Many of those localities were visited by the author, but many by his contemporaries, notably Benjamin Silliman, John P. Brace, Amos Eaton, George Gibbs, and James G. Percival.

III. Scenery

In the final section Hitchcock described fourteen summits and three waterfalls of exceptional beauty in the study area. The inspiration for this section no doubt came from Benjamin Silliman's 1820 article in the second volume of *AJS*.[104] Hitchcock offered this rationale for including it in his article: "[We] here find a rich diversity of scenery, so that not only the geologist, but the poet and the painter, and every man of correct taste, will find an interest in its beauties. My object at this time is to refer to a few of the most interesting and romantic spots along this river, annexing a short description to each."[105]

In Connecticut he described six mountains or hills offering wide panoramas, beginning with two of the most dramatic geological features of the state

[102] Hitchcock, "Sketch," *AJS* 6, 215.
[103] Ibid.
[104] Silliman, "Sketches," 1820.
[105] Hitchcock, "Sketch," *AJS* 7, 2.

of Connecticut, East Rock and West Rock, in New Haven: "The eminences thus named have long been celebrated, and attract the attention of the visitor who first enters the harbour or the city of New-Haven, as most singular features in the landscape—the one lying north west and the other north east, about two miles distant. They present their naked fronts towards the city, nearly four hundred feet high, of an iron rust colour."[106]

He went on to describe Prospect Hill in East Haven; an unnamed high point in West Haven offering a sweeping view of Long Island Sound; a viewpoint in what is known today as the Upper Houses Historic District in Cromwell; and Talcott Mountain northwest of Hartford. Of Monte Video, the estate at the summit of Talcott Mountain constructed by artist and architect Daniel Wadsworth a decade earlier and known today as the Heublein Tower, he wrote,

> The beauties and sublimities with which nature has invested this spot, both on a limited and an extensive scale, are greatly increased by the displays of an enlightened and correct taste in the disposition and adaptation of the various objects which this singular country residence exhibits; such as the tenant's house in Gothic style; the summer house; the boat upon the mountain lake, and rising in Gothic grandeur above the trees, the hexagonal tower, whose top is nine hundred and sixty feet above the Connecticut.[107]

Sisyphean Bowlders

Edward Hitchcock, like many scientists of his day, was still wedded to a biblical estimate for the Great Flood of some 6,000 years before the present. He made no mention of the ages of the rock formations in "Sketch,"[108] but in a short section entitled "Cosmogonical Chronometer" he argued that a careful examination of the accumulation of debris at the base of a greenstone rockface might allow an estimation of the time since that rock was formed:

> Now every one must see that this levelling work cannot have been going on forever; and when we consider how very considerable is the quantity of

[106] Ibid.

[107] Ibid., 5.

[108] In an 1824 sermon he wrote, "After the lapse of nearly 6000 years the harmony and regularity of the motions of the heavenly bodies remain the same as at the beginning." Sermon No. 209, "Truth of God," 1824 Feb, EOH, Series 3, Sub-series A, Box 8, Folder 5. The now familiar names of the geological periods (Silurian, Devonian, Carboniferous, etc.) were not adopted until the 1830s and do not appear in Hitchcock's works until the 1840s. For example, Hitchcock, *Elementary Geology* (Amherst, MA: J. S. and C. Adams, 1840) and Hitchcock, *Final Report*, 1841

> rock yearly detached, and compare this with the whole amount of the debris, the conclusion forces itself upon us that the period when this process began could not have been vastly remote; in other words, that the earth has not existed in its present form from eternity. Its precise age cannot, indeed, be determined by this chronometer; but I have often thought that, judging from this alone, we should be led to conclude that Moses placed the date of the creation too far back, rather than not far enough.[109]

Eventually Hitchcock was persuaded of the great age of the earth. Under the influence of Scottish geologist Sir Charles Lyell and others, in his 1833 report he allowed for an earth of great antiquity with "numerous deluges" before the Great Flood. He then added an important point regarding his evolving view of science and religion:

> And why should we hesitate to admit the existence of our globe through periods as long as geological researches require; since the sacred record does not declare the time of its original creation: and since such a view of its antiquity enlarges our ideas of the operations of the Deity in respect to duration, as much as astronomy does in regard to space? Instead of bringing us into collision with Moses, it seems to me that geology furnishes us with some of the grandest conceptions of the Divine Attributes and plans to be found in the whole circle of human knowledge.[110]

That phrase, "geology furnishes us with some of the grandest conceptions of the Divine Attributes," expresses succinctly the fundamental principle of Edward Hitchcock's life: that science does not threaten religious faith, it fulfills it.

He then made an important observation regarding the history of the earth:

> Along the Connecticut in the primitive region, large bowlders in great numbers are not commonly found removed many miles from the spot where they originated . . . in general along this river, the character of the rolled masses corresponds to the rock in place underneath them—that is the greatest number of the loose stones are of the same description as the rock that underlies them. **But to this there are many exceptions—a most remarkable one occurs a few miles west of New-Haven in Woodbridge and Milford**. . . . The diameter of the loose fragments varies from an inch to twenty, or even thirty feet, and they are usually rounded, indicating attrition. Some of the highest of these bowlders are found insulated on the pinnacles of our mountains.[111] (emphasis added)

[109] Hitchcock, "Sketch," *AJS* 6, 55–6.
[110] Hitchcock, *Report*, 222–23.
[111] Hitchcock, "Sketch," *AJS* 6, 83–84.

Some of those boulders can still be found including Liberty Rock in Milford and one in Woodbridge that has been dubbed "Frankenrock."

Now Reverend Hitchcock was not one to trifle with God's word. But he was also an astute observer, particularly on matters geological, and those "bowlders" troubled him, even in 1823. Near the end of his "Sketch" Hitchcock hinted at some misgivings about the diluvial hypothesis: "No current of water with which we are acquainted is sufficient to transport such masses of rock into the situations in which we find them."[112] Here he inserted a quotation from the recent publication of Conybeare and Phillips mentioned above:

> [F]or though we can readily conceive how the agency of violent currents may have driven these blocks down an inclined plane, or, if the vis a tergo [i.e., propulsive force] were sufficient, along a level surface, or even up a very slight and gradual acclivity, it is impossible to ascribe to them the Sisyphean labour of rolling rocky masses, sometimes of many tons in weight, up the face of abrupt and high escarpments.[113]

Hitchcock then added, "Rounded masses of rock may however occur under such circumstances as to show them to have been removed by currents posterior to the deluge."[114]

It is clear from these paragraphs that Hitchcock's Connecticut Valley research had led him to doubt the sufficiency of the Great Flood of Genesis, the flood of Noah and his Ark, to explain transport of huge boulders. He was not denying the biblical deluge. Rather he was suggesting that a subsequent event may have been equally important. Here Hitchcock seemed to be ahead of his time:

> At the outlet of the Connecticut through the mountains below Middletown, a little south of the Chatham cobalt mine, and six or seven hundred feet above the present bed of the river, I saw rounded masses of old red sandstone, several inches in diameter, mixed with the fragments of the rocks in place. Such a fact I never noticed at any other place in the primitive region along the river: certainly not on the east side of it. **And I was led irresistibly to the conclusion, that they were conveyed thither by the ice of the ancient lake, which would be floated to the ocean through this outlet**.[115] (emphasis added)

[112] Hitchcock, "Sketch," *AJS* 7, 17.

[113] Hitchcock, "Sketch," *AJS* 7, 17; the quotation is from Conybeare and Phillips, 1822, xxix.

[114] Ibid.

[115] Hitchcock, "Sketch," *AJS* 7, 18.

More weight was added to this idea when Hitchcock traveled to Martha's Vineyard, Massachusetts, the following summer.[116] There he observed similar rounded boulders that he concluded originated on the mainland to the north. During his geological survey of Massachusetts, he found dozens of examples of boulder trains with similar orientations, some of them of mammoth proportions. In the 1833 report of that survey, Hitchcock for the first time made his doubts about the "diluvial hypothesis" explicit: "Making every allowance for the reduction of the gravity of these bowlders when in water, I confess I cannot conceive how such a work could have been effected by this agency [i.e., by water]."[117]

Then, in late 1840, Hitchcock received a copy of a recently published book entitled *Études sur les Glaciers* authored by a Swiss scientist named Louis Agassiz. Agassiz proposed the revolutionary idea that ice, not water, was the principal agent responsible for sculpting much of the surface of the northern hemisphere, that an enormous ice cap had accumulated in the polar regions to the north, gradually expanding southward over millennia. It was a glacier or series of glaciers of vast extent, and it gouged, scraped, and bulldozed the surface of the earth as it advanced.[118]

When Edward Hitchcock read Agassiz's treatise, he quickly became a convert. In an address before the Association of American Geologists in Philadelphia in April 1841, he presented a summary of Agassiz's theory of continental glaciation with evangelical zeal: "While reading this work . . . I seemed to be acquiring a new geological sense; and I look upon our smoothed and striated rocks, our accumulations of gravel, and the tout ensemble of diluvial phenomena, with new eyes."[119]

Hitchcock's endorsement gave Agassiz's theory wide exposure among American scientists, although there remained a good deal of resistance in some quarters. In fact, Hitchcock himself equivocated on the idea, espousing

[116] Edward Hitchcock, "Notices of the Geology of Martha's Vineyard and the Elizabeth Islands," *AJS* 7, no. 2 (1823): 240–48.

[117] Hitchcock, *Report*, 158.

[118] Louis Agassiz, *Études sur les Glaciers* (Neuchatel, Switzerland: Jent et Gassmann, 1840).

[119] Edward Hitchcock, "First Anniversary Address Before the Association of American Geologists," *AJS* 41, no. 2 (July–Sept. 1841): 253. Another important form of evidence in support of Agassiz's theory was gouges or striae in bedrock oriented north to south or northwest to southeast. While Hitchcock observed many striae across Massachusetts in his geological survey, he made no mention of striae in Connecticut in his "Sketch." In 1825 Peter Dobson, a cotton manufacturer, wrote Benjamin Silliman regarding striae he observed in bedrock unearthed during excavation for a mill in Vernon, the first to be reported in Connecticut: Peter Dobson, "Remarks on Bowlders," *AJS* 10, no. 2 (1826): 217–18.

an alternative explanation he called the "glacio-aqueous hypothesis."[120] But the evidence was strong—by the 1860s, the concept of continental glaciation had been embraced by most scientists in America and worldwide. It was not Hitchcock's brainchild, but he played a key role in its ultimate acceptance by American geologists. And the first glimmer of insight into that phenomenon seems to have come to Edward Hitchcock during his explorations around New Haven between 1819 and 1822.[121]

Reactions

In a letter to Edward Hitchcock written just weeks after the publication of the first two installments of his "Sketch," Benjamin Silliman was effusive in his praise of that work: "It is in my view the ablest thing that has been done in that way on this side of the water."[122] While Silliman may not have been entirely impartial in the matter, few scientists of that day were better situated to judge Hitchcock's latest work.

Benjamin Silliman was by no means alone in his enthusiasm for Hitchcock's "Sketch." In an article entitled "Sketch of the Geology and Mineralogy of the western part of Massachusetts, and a small part of the adjoining States" that appeared in the next volume of *AJS*, Chester Dewey praised Hitchcock's work and included a map and profile of Berkshire County, both drawn by Orra White Hitchcock in the same style as her Connecticut Valley map. Five years later that same map appeared in Dewey's history of Berkshire County.[123]

Amos Eaton, one of the most influential American geologists of that time, also praised Hitchcock's work. Eaton was then undertaking a geological survey of the proposed route of the Erie Canal under the sponsorship of Stephen Van Rensselaer. In his 1824 report on that project, Eaton wrote, "Every

[120] Edward Hitchcock, "The Phenomena of Drift and Glacio-aqueous Action in North America," *Reports of the First, Second, and Third Meetings of the Association of American Geologists and Naturalists* (Boston, MA, Gould, Kendall and Lincoln, 1843), 164–221.

[121] For discussions of Hitchcock's role in the debate about continental glaciation, see Robert Silliman, "Agassiz vs. Lyell: Authority in the Assessment of the Diluvium-Drift Problem by North American Geologists, with Particular Reference to Edward Hitchcock," *Earth Sciences History* 13, no. 2 (1994): 180–86; and Jordan D. Marché II, "Edward Hitchcock, Roderick Murchison, and the Rejection of the Alpine Glacier Theory," *Earth Sciences History* 37, no. 2 (2018): 380–402.

[122] BS to EH, January 25, 1823, EOH, Box 3, Folder 38.

[123] Chester Dewey, "A Sketch of the Geology and Mineralogy of the western part of Massachusetts, and a small part of the adjoining States," *AJS* 8, no. 1 (1824): 1–60; David D. Field and Chester Dewey, *A History of the County of Berkshire, Massachusetts* (Pittsfield, MA: Samuel W. Bush, 1829).

American geologist sets a high value on Mr. Hitchcock's geological map of the district adjoining Connecticut River, published in Silliman's Journal . . . Probably no American is more competent to perform this work; and as the American nomenclature for primitive rocks is not well settled, Mr. H.'s views of them was considered of importance by Mr. Van Rensselaer. At his request, Mr. H. prepared the annexed profile and explanations."[124]

A year later in the ninth volume of *AJS*, amateur geologist Reverend Austin O. Hubbard wrote, "I have been much pleased and instructed by the perusal, in the Journal of Science, of Mr. Hitchcock's excellent description of the Connecticut Valley. He has done the subject ample justice, and himself the more honour, from the circumstance that most of the geological facts which he mentions, are the result of his own accurate observation. What he has described, he has examined, and examined closely."[125]

Conclusion

Hitchcock's "Sketch" thrust him into the limelight in the fledgling field of American geology. Its scope and detail attested to the author's energy and diligence; his discussions of rock formations demonstrated his familiarity with the latest geological thought both in North America and in Europe; and his descriptions of the scenery of the study area gave the work even broader appeal. What is more, it demonstrated how this young, largely self-taught geologist had the ability to break new ground and gain new insights, often decades ahead of his peers. That work proved to be a career-changer for its author as well. Of the nineteen scientific articles Hitchcock published over the previous decade, his "Sketch" was by far the longest and most ambitious. That article, capping his already impressive record of publication in the field, likely weighed strongly in his favor when he was appointed to the faculty of Amherst College in August 1825. He went on to teach geology, chemistry, and natural history at Amherst for nearly forty years, including his nine-year term as president of the college, from 1845 to 1854.

Hitchcock's article was also a milestone for the state of Connecticut. The state was already the hub of American geology in 1823. Yale College housed the Gibbs Mineralogical Cabinet, one of the largest geological collections in North America. Yale was also the home of Silliman's *American Journal of*

[124] Amos Eaton, A geological and agricultural survey of the district adjoining the Erie canal in the state of New York. (Albany, NY: Packard & Van Benthuysen, 1824), 47, 157.

[125] Arthur O. Hubbard, "Remarks on the lead veins of Massachusetts, etc.," *AJS* 9, no. 1 (1825): 166–67.

Science, the first scholarly journal devoted to science in the young nation, and of the American Geological Society, the nation's first professional geological organization. But with the publication of Hitchcock's "Sketch," Connecticut could now lay claim to the first large-scale geological survey in the nation as well as the most precise geological map created in North America until that time. From that day forward, the Constitution State would be linked with one of the brightest young stars in the firmament of American science in the nineteenth century.

The publication of Hitchcock's "Sketch" became an important landmark for American geology as well. It was in many respects the first of an entirely new kind of geological writing in the United States, unique both in scope and content. It drew on the works of contemporaries such as Silliman, Eaton, and Brace, but added many elements of style and content that were the author's own. It was the first American geological study to use the classification system of Conybeare and Phillips. It also addressed some of the major questions facing American geologists at that time such as the nature of the coal formations, the distinction between "old red sandstone" and "new red sandstone," and the debate between followers of Werner and Hutton regarding the origins of this planet.

Perhaps most significantly, in that article Hitchcock made a vital contribution to the understanding of the geological history of New England and North America. He did not originate the theory of continental glaciation, but his hypotheses about the ancient lakes of the Connecticut Valley, the geest deposits, and those curious "rolled masses" he first observed near New Haven likely resonated strongly among fellow geologists when, a decade and a half later, that theory was finally brought before them. Furthermore, the discovery of organic remains of fish, a mammal, and tree trunks helped to advance the field of American paleontology that in time played a critical role in reconstructing the geological history of the region.

Also among Edward Hitchcock's enduring contributions to American geology were his state geological surveys of Massachusetts (1830–1841) and Vermont (1857–1860).[126] Seven years after the publication of his "Sketch," he was appointed to carry out a geological survey of Massachusetts. That survey followed much the same format as his Connecticut Valley research.

[126] Robert T. McMaster, "Edward Hitchcock's Geological Survey of Massachusetts: 1830–1833," *Earth Sciences History* 39, no. 1 (2020): 99–119; Robert T. McMaster, "Against the Odds: Edward Hitchcock and the Vermont Geological Survey," *Vermont History* 91, no. 2 (2023): 103–109.

It included intensive field reconnaissance over several years, collection of thousands of rock, mineral, and soil specimens, measurements of the strikes and dips of hundreds of strata, and the creation of detailed maps and profiles of the region's bedrock. His state survey reports mirrored his "Sketch" in both format and style, methodically identifying and describing each rock formation and interpreting those formations based upon current geological thinking both in North America and in Europe. Furthermore, his reports included not only scientific interpretations but vivid descriptions of scenic landscapes that would attract nonscientific readers.

The impact of those surveys on American geology was enormous. Within two decades some twenty states undertook similar projects using the Massachusetts survey as a template.[127] The Connecticut legislature funded the first survey in that state in 1835. It was carried out jointly by Charles U. Shepard and James G. Percival who submitted their reports in 1837 and 1842, respectively.[128] Those state geological surveys may be some of the earliest instances in US history of scientists and academic institutions collaborating with states governments on projects of mutual interest. More than seventy years later George Perkins Merrill, geologist and curator of geology at the Smithsonian's National Museum of Natural History in Washington, D.C. wrote that Hitchcock's 1833 report "marks an epoch in American geological work."[129]

Epilogue

Just a few days after the first installment of "Sketch" appeared in print, Reverend Hitchcock delivered a sermon on the "Noachian deluge" to his congregation. It was a discourse intended for those who harbored doubts about the truth of Holy Scriptures. We can imagine the pastor lifting his eyes to the hills that surrounded them as he spoke these words:

> Whence came these numerous worn and rounded masses of stone which are scattered over the tops of our highest hills and mountains? Surely no river could have conveyed them thither. Nothing will account for their situation

[127] Walter B. Hendrickson, "Nineteenth-Century State Geological Surveys: Early Government Support of Science," *Isis* 52, no. 3 (September 1961): 361.

[128] George P. Merrill, *Contributions to a History of American State Geological and Natural History Surveys* (Washington, DC: Government Printing Office, 1920), 45–50.

[129] George P. Merrill, *Contributions to the History of American Geology* (Washington, D.C.: Government Printing Office, 1906), 307.

> but an universal deluge. Let the unbeliever then remember that as he passes over our hills the very stones cry out against him.[130]

We now can see that those stones were also crying out to Edward Hitchcock, but they were telling him quite a different story from that of a universal deluge. Some of those "worn and rounded masses" were simply too large to be carried by a flood no matter how powerful. And that layer of geest deposited so widely over rugged terrain? And those great lakes that once inundated much of the Connecticut River Valley? They all hinted at a very different narrative from that of Noah and the Great Flood in the Book of Genesis. He was not yet certain what that story was, although he had an inkling that it might just have to do with ice.

A decade passed before Professor Hitchcock made public his doubts about the "diluvial hypothesis"—and nearly two decades before he found a suitable explanation. But the publication of his "Sketch" in January 1823 might have been the very moment when Edward Hitchcock realized what his life's work must be about, reconciling the facts of science with Holy Scripture. He must convince scientists, clergy, and lay people alike that despite mounting scientific evidence that the Bible was wrong in some important respects, science and religion need not be enemies. Nearly thirty years later Hitchcock published what he considered the most important work of his career, *The Religion of Geology*, that addressed that very question.[131]

Edward Hitchcock was born in and lived nearly his entire life in Massachusetts. So it is not surprising that his name is most often associated with the Bay State. But his affiliations with Connecticut early in his adult life including his friendship with Benjamin Silliman, his close ties to Yale, and his extensive research on the geology of the Constitution State, were formative. It was in Connecticut that he preached his first sermon, carried out his first large-scale geological survey, came to question some of the eternal truths of the Bible, and had the first inklings of insight into continental glaciation. Why Connecticut? Was it something in the air—in the rocks—or in the soil? Perhaps it was that spirit of curiosity and desire to pursue truth, scientific as

[130] "Noachian Deluge," Sermon No. 128, January 23, 1823, EOH, Series 3, Sub-series A, Box 7, Folder 7.

[131] Edward Hitchcock, *The Religion of Geology and Its Connected Sciences* (Boston, MA: Phillips, Sampson, and Company, 1851); in his "Private Notes," November 1843, he wrote, "During the last summer I completed the work which has occupied my leisure time for two years viz. ten lectures on the Religion of Geology. It is the result of long study upon the subject: and as I consider the religious applications of science to be its most important use, I look upon these lectures as the most valuable of my scientific studies."

well as spiritual, wherever it led, a spirit that has characterized the Constitution State and its citizens for more than three and one half centuries.

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