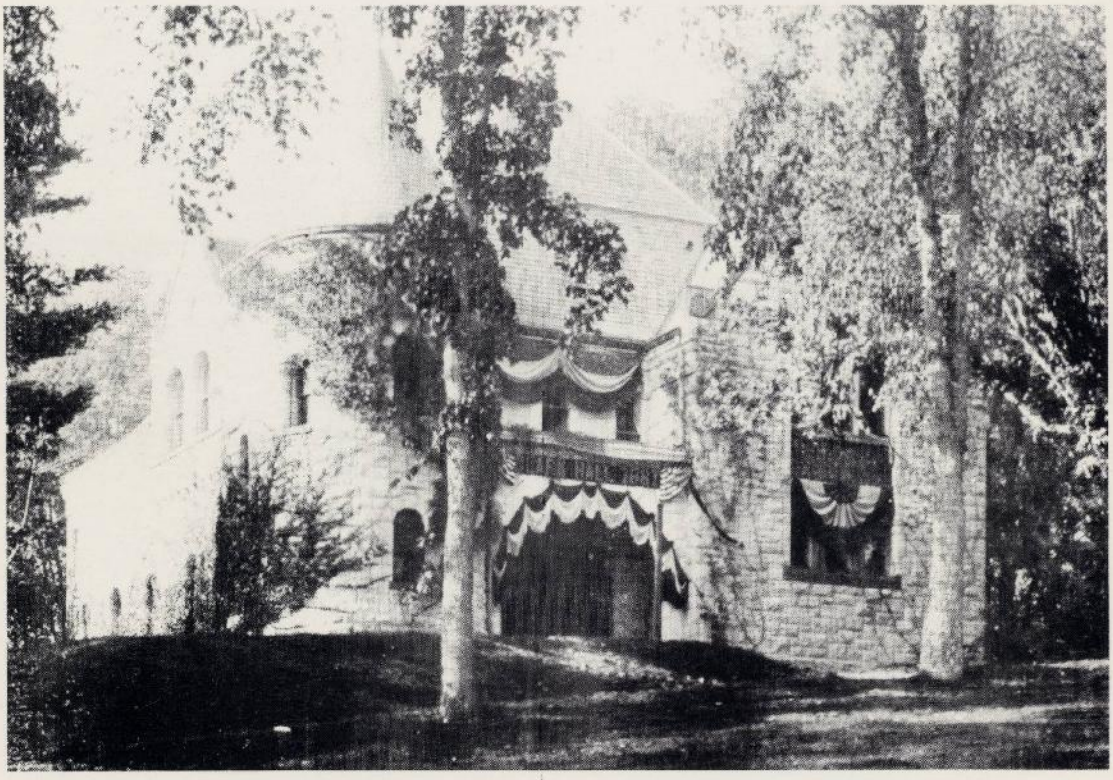
WILLIAMS GEOLOGY NEWSLETTER



Volume II
June 1993

Bicentennial
Edition

Williams College
Williamstown, MA

WILLIAMS GEOLOGY NEWSLETTER

BICENTENNIAL EDITION

VOLUME II SUMMER 1993

Cover: The original Clark Hall, in the Berkshire quad, decked out for the Williams Centennial in 1893.

The Williams Geology Newsletter is published by the Department of Geology, Williams College, Williamstown, MA 01267. This edition has been assembled and edited by R. A. Wobus and Pat Acosta, with contributions from other department members as acknowledged.

WILLIAMS' FIRST GEOLOGISTS

(contributed by Prof. Markes Johnson)

The names of three geologists are intimately linked with Williams College for the period spanning the first half of the 19th century. They are Amos Eaton (1776-1842), Chester Dewey (1784-1867), and Ebenezer Emmons (1799-1863). The deformed rocks of the Taconic Range, sprawling from western Massachusetts into neighboring New York and Vermont, were for these geologists a valuable resource for both classroom instruction and scholarly research. Each in turn was drawn to this complex region by association with the college, utilized students in

local mapping projects or the making of cross sections, and did his best to promote ever-changing interpretations with his contemporaries. By the middle of the 19th Century, this process led to the great Taconic controversy. It is a spell-binding story that parallels the passions of the Murchison-Sedgwick feud in early Victorian England (Secord, 1986) but with a peculiar American twist involving a court trial to discredit a scientific concept. The stakes were high; nothing less than the definition and world-wide correlation of the series of strata known as the Taconic System. This tale, briefly summarized here, has been treated from a variety of historical viewpoints by Clark (1921), Merrill (1924), Rodgers (1970), Schneer (1978), and Johnson (1982).

The Eatonian Era

In his book "The First One Hundred Years of American Geology," Merrill (1924, p. 35) calls the 1820's the Eatonian Era, in tribute to the astonishingly effective public promotion of geology (among the other sciences) by Amos Eaton. Although chiefly remembered as a geologist today, this rustic figure was nothing less than the one-man equivalent of an army of zealots with an all-consuming passion for science education. His greatest contribution to American geology was probably his training of an entire generation of geologists who staffed the earliest state geological surveys (Johnson, 1977). Eaton's legacy to contemporary America is alive and well in the form of the Rensselaer Polytechnic Institute in Troy, New York, founded by him in 1824. The most complete source on the details of Eaton's life is the biography by McAllister (1941).

Amos Eaton was a native of eastern New York State who attended Williams College and graduated in 1799 at the age of 23. No science courses (aside from the mathematical sciences) were taught at the college during his student years. Afterwards, Eaton entered into a career combining law and land surveying in the nearby Catskill region of New York. By 1810 he was already experimenting with science education through his efforts to found a botany school in the Catskills. The surviving record is sketchy, but Eaton was accused and subsequently convicted of a forgery related to his land-speculation business. The punishment handed down by the court for this crime was life imprisonment in New York's Newgate Prison. During his imprisonment, Eaton used his free time to read science books, and he soon became a "born-again" geologist. Granted a pardon late in 1815 at the age of 39, Eaton went early in the next year to Yale College to study geology and mineralogy under Benjamin Silliman.

In 1817, Eaton returned to Williams College by special invitation to offer the school's first courses in field geology, mineralogy, and botany. One of his pupils was a serious 18 year-old named Ebenezer Emmons. By the next year, the industrious ex-convict had published a geology textbook (Eaton, 1818), which he dedicated to his Williams students. Addressing them in the the introduction, he wrote: "Your frequent and just complaint that there is no elementary treatise to aid you in the application of geological science to the district of country which you are accustomed to visit, induced me to make a systematic arrangement of the following collection of facts; I have endeavored to make the local references as particular, as to lead you directly to the very spot where each rock stratum, or imbedded mineral is to be found."

The rock-classification scheme espoused by Eaton (1818) was a combination of pure lithostratigraphic description and a modified Neptunian or Wernerian chronostratigraphy that did not deny the most obvious classes of volcanic rocks. He divided the rocks of the northern states into five categories: 1) the Primitive rocks, having no trace of fossil animals or plants, 2) the Transition rocks, sometimes containing fossils of sightless animals and plants such as ferns, 3) the Secondary rocks, sometimes containing the fossil remains of seeing animals and woody plants, 4) the Superincumbent rocks, consisting of fine-grained hornblende aggregates (i.e., basalt, trap, and related rocks), and 5) the Alluvial deposits, made up of unconsolidated materials. Volcanic productions, such as lava, obsidian, and pumice, were treated in a separate classification, but he suggested they might belong to the Superincumbent class. Although an orderly progression of plant and animal types would seem to play a role as index fossils in this scheme, their utilization was superficial at best. Eaton placed the greatest emphasis on "the most important mineral embraced" in each rock stratum. In this approach he was greatly influenced by Robert Bakewell (1768-1843), whose book on English geology he first had read with religious zeal while an inmate of Newgate Prison. His acceptance of the Wernerian notion that the mineralogy of successive rock layers follows a chronostratigraphic pattern was later to lead to error, as illustrated by his correlation of the Silurian "Saliferous" rocks of New York with the Permian "Saliferous" rocks of England (Schneer, 1969, p. 442-443, Fig. 1). Only toward the end of his career did Eaton appreciate more fully the value of fossils as time keepers and as a means of long-distance correlation.

Nonetheless, Eaton earns high marks for his boundless enthusiasm and his ability to rouse students from the traditional classroom into nature's outdoor classroom in order to study rocks. While at Williams College, for example, he conducted a walking tour from Williamstown to Northampton (on the edge of the Connecticut River valley) and enlisted his students in the collection of data for a geological cross section through western Massachusetts. During this trip the students collected samples, arranged with local farmers for meals, and at night slept in hay lofts. Unfortunately, Eaton's career with the college was brief. Athough his skill as a teacher was recognized by the administration, it was considered improper to offer a convicted felon a full-time position on the faculty. Doubtless the administration felt it was granting a former student a new start in life with the experience of a single academic year. Armed with recommendations, Eaton soon returned to New York. The details of his geological exploits there, including a suggestion of facies relationships between the Old Red Sandstone and marine strata well before the untangling and formal definition of the Devonian System in England, are told by Wells (1963) and Johnson (1987).

The Dewey Interlude

Chester Dewey was a native of western Massachusetts who not only attended and graduated from Williams College (class of 1806) but later returned as a member of the faculty. For his life and career, we have only short necrologies (Gray, 1868, p. 122-123; Anderson, 1871). Although Dewey is remembered chiefly as a mathematician in the service of the University of Rochester, his early career included geological field work in the Berkshire Hills. He was called back to Williams College in 1808 as a tutor. In 1810 he was appointed professor of mathematics and natural philosophy, a post he held until 1827. Under the guise

of "natural philosophy," Dewey apparently was responsible for initiating the first course in chemistry at the college. As with Benjamin Silliman during his early years at Yale, the study of chemistry under Dewey at Williams was organized to include a good deal of mineralogy. His most important achievement during these years was the completion of a geological map and report on Berkshire County. The first installment on this project was a report on the mineralogy and geology in the immediate vicinity of the college (Dewey, 1819); the final product was a geological map of Berkshire County (Dewey, 1824), the first geological map of western Massachusetts and parts of the adjoining states.

In the first report, the term "Taconick" (an Indian name) was introduced to the geological literature, although only as a geographical term. That report was published while Ebenezer Emmons attended Williams College. According to Marcou (1891, p.1), Emmons was one of Dewey's favorite pupils, and according to Schneer (1978), Emmons was Dewey's field assistant on the mapping project. Dewey (1824, p. 32) himself acknowledged: "Most of the minerals of these towns [Middlefield and Chester] have been discovered by Dr. E. Emmons of Chester, an indefatigable and acute observer." In any case, their lasting friendship is clearly shown by the important role Dewey later played in promoting Emmons' Taconic System long after he departed for Rochester. It was Dewey who independently arranged for Joachim Barrande to recieve a set of Emmons' key publications on the Taconic System. This indicates that, while Dewey later ceased to do geological field work, he kept abreast of contemporary developments in that field. Emmons is also listed as one of Amos Eaton's students in 1817, under whom he would certainly have gained additional field experience in western Massachusetts.

Emmons and the Taconic Controversy

From the stern gaze of his portrait in the Geology Library, Ebenezer Emmons appears to have been a stiff and rather sour individual. According to one early biographer (Marcou, 1891, p. 1), he was religiously strict in defining the Sabbath as the interval from sunset on Saturday evening to sunrise on Monday morning. He certainly had every right to feel sour, based on his treatment by contemporary American geologists. It is always unhappy enough to have one's ideas occasionally rejected by peer review, but how many geologists have been forced to defend their concepts in a court of law? In the strange case of the Taconic controversy, all the most prominent American geologists including James Hall, Louis Agassiz, James D. Dana, W. W. Mather, and Edward Hitchcock were pitted against Emmons. Charles Lyell, who had visited the Taconic Range during his American trips, even volunteered to testify against Emmons (Schneer, 1978). Despite all this, Emmons is said by his son to have maintained "a cheerful and playful disposition" throughout his life (Marcou, 1891, p. 1). Another biographer who knew him as a colleague at Williams College (Hopkins, 1864) relates that Emmons was never bitter, but was steadfast in his expectations to save his reputation. The young Emmons was well disposed to the natural sciences before entering Williams College in 1816. Like Dewey a native of western Massachusetts, he was an avid collector of local minerals, plants, and insects. Emmons graduated from Williams in 1818 and thereafter enrolled at the Albany Medical College, in Albany, New York. He subsequently practiced general medicine and surgery in Berkshire County for 15 years. After Dewey left Williams College, Emmons took his place as lecturer in chemistry in 1828 and was elevated to

professor of natural history in 1833. His title eventually was professor of geology and mineralogy, and he held this post until his death in 1863, even though in later years his home was in New York and finally North Carolina. Emmons was also associated with Eaton's Rensselaer School in Troy from 1833 to 1837 and with the Albany Medical College from 1838 to 1852, where he was first professor of chemistry and then professor of obstetrics. Professionally he is best remembered as one of the four geologists appointed in 1836 to survey the State of New York and as the State Geologist of North Carolina, appointed in 1851.

There is no doubt, however, that geology, and particularly the geology of the Taconic area, was Emmons's favorite avocation in life. His fullest treatise on the Taconic System is a privately published report covering the geology of parts of New England and eastern New York (Emmons, 1844). The centerpiece of this report was the description of two new trilobites, Elliptocephala asaphoides and Atops trilineatus from near Bald Mountain in Washington County, New York. Emmons claimed that these trilobites and their associated strata were older than the Potsdam Sandstone. As the Potsdam Sandstone rests unconformably on Primary or Primitive rocks in northern New York and was understood to represent the base of the "Transition rocks" regionally, Emmons felt justified in proclaiming an entirely new system between the Transition and the Primary. This system not only included the Taconic Range and part of the western flank of the Green Mountains, and the intervening marble valley, but was extended by Emmons to several parts of New England, Michigan, and eventually Quebec and many of the southern states. By today's standards, the oldest rocks described by Emmons would include much of the Cambrian and the Precambrian Ediacarian, but much of the area he attributed to the Taconic System (both in New England and in the south) also involves younger strata.

Ebenezer Emmons was one of the key figures in transforming American geology from the Wernerian concept of chronostratigraphy based on mineral content and attitude to the familiar hierarchy of stratigraphic units bearing local names and arranged in temporal order on the basis of faunal succession (Schneer, 1969). The nomenclature of the "New York Transition System" and its subdivisions - the Champlain, Ontario, Helderberg, and Erie groups - were introduced in Emmons' final report on the geology of the second district (Emmons, 1842). A host of local formation names still in use today were first introduced by the New York geologists including Emmons, in their annual reports starting in 1838. One of Emmons' main goals was the introduction of an American terminology, in opposition to adoption of the European system on nomenclature. Thus it is not peculiar that he should also attempt to broaden this system of nomenclature with the introduction of the Taconic System.

Sedgwick first introduced the term Cambrian in 1836 for strata which would be partly equivalent in age to the Taconic, as Emmons acknowledged (1842, p. 163). His clear priority would not have concerned Emmons at first, since the American geologist was interested in establishig an American nomenclature. Emmons' later claims for the authorship of a world-wide system were strengthened because Sedgwick was never able to muster the paleontological evidence for his Cambrian System in the type area of northern Wales. In any case, the New-York System died an early death as the Silurian and Devonian systems gained in global popularity. The strong American opposition to the Taconic System was clearly

fueled by the influence of Murchison in spreading his concept of the Silurian System at the expense of Sedgwick's Cambrian System. Clarke (1921, p. 158-162) printed the contents of an important letter written by Murchison to James Hall at the close of 1846, in which Murchison urges the use of the Silurian System in America and the suppression of the Cambrian System. According to Murchison's interpretation, the Silurian System formed the base of the so-called Transition series over basement rock. There was no space for any other terminology at this position. Hall subsequently denied that Emmons' trilobites were anything else than Silurian in age (Schneer, 1978).

From his early boyhood days collecting minerals until the closing days of his career in North Carolina, Emmons took every opportunity to promote the geology of the Taconic area on a regional to interregional basis. As a student at Williams, he helped his professors make geological profiles and maps of western Massachusetts. Although the second geological district of New York included none of the rocks Emmons called Taconic, he used his final report on that district (Emmons, 1843, p. 135-164) to introduce the new system, rather to the dismay of Mather, in whose district those rocks lay (Mather, 1843, p. viii). When Emmons' term as geologist in New York ended and he subsequently became the state agriculturist, he embedded his 1844 treatise on the Taconic Ssytem in the first volume of his five-volume report on the Agriculture of New York, published under state authority (Emmons, 1846-1854, v. 1, p. 45-112). The 1844 report includes a number of cross sections extending from New York well into Vermont and Massachusetts.

The final rupture with James Hall (who had been a field assistant to Emmons in the second district) resulted from the publication of a geological chart by James T. Foster. When Hall and Agassiz published critical reviews of the chart urging its ban, Foster sued both for libel. Emmons was then called in as a consultant to Foster on a new design, so it was not suprising that the new chart included Emmons' Taconic System (the first had not). Details of the first court case in 1851, Foster vs. Agassiz, are covered by Clark (1921, p. 204-213), Schneer (1978), and Johnson (1982). Emmons was called to appear as a witness for the prosecution, and the trial immediately turned into an examination of Emmons' professional competence. The jury concluded that Foster had no grounds to sue Agassiz, and the companion case, Foster vs. Hall, was abandoned. Copies of the Foster chart mysteriously disappeared, and a new chart free of the Taconic blemish, authored by none other than James Hall, was subsequently marketed to the New York public school system.

The trial and all its publicity was a public humiliation to Emmons. The original participants against Emmons, and many later commentators, assumed that it marked the end of his geological career. At this point, however, Emmons simply removed himself to North Carolina, where he continued to work on the Taconic System as state geologist. Emmons' second career in the south is described in detail by Johnson (1982). Under state authority, he published on fossils belonging to the lower part (Ediacarian equivalent) of the Taconic System (Emmons, 1856, p. 60-64). These fossils he proudly maintained to be the oldest in the world. The specimens have long since been lost, and their authenticity as fossils is questioned today. Nearby localities in North Carolina, however, have recently yielded authentic Ediacarian fossils (Gibson and others, 1984). During this period, Emmons also wrote two geology textbooks (Emmons, 1854-1857, 1860), and these were used to further the cause of the Taconic System.

Strangely enough, Emmons never mounted an international campaign on behalf of his Taconic System. As mentioned above, his former teacher, Chester Dewey, took the initiative to contact Barrande in Prague. Jules Marcou also acted on his behalf as an intermediary with the French geologist. The first substantial support of Emmons as discoverer of the "Primordial" trilobite fauna (in Barrande's terminology) was from Barrande (1861). We all know that the Cambrian System, not the Taconic System, eventually received world-wide recognition. Despite serious errors in his stratigraphy, Emmons' reputation remains secure as the first geologist to publish on fossils of "pre-Silurian" (i.e., pre-Ordovician) age.

Conclusions

Eaton, Dewey, and Emmons are bound together by their relationships to Williams College and their mutual interest in the rocks of the nearby Taconic Range. Eaton and Emmons were particularly ambitious geologists, and it is interesting to look back on their careers in this academic setting. Many aspects of their annual routine have not changed much with time. They taught in the classroom, they organized student field trips, they did summer field work, they attended professional meetings, they wrote textbooks, and they wrote scholarly treatises. Eaton was more the innovative educator, but Emmons was more the innovative geologist. Their impact on the fabric of American geology lasted long into the 19th Century.

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