

# New England

*The Culture and History of an American Region*

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568 Geography and Environment

A project of the Center for the Humanities at the University of New Hampshire

YALE UNIVERSITY PRESS / NEW HAVEN & LONDON

**Geology** Many think the discipline of geology to be the study of rocks. But this definition is too restrictive because the word *geology* translates as the science (*logos*) of the whole earth (*geo*), not merely its *petra*, which is short for its rock. Geologists try to understand how all of earth's materials—rock, air, water, and life—interact as components within a single global system. Furthermore, geology is much more than a technical field allied with mining, oil exploration, mineral collecting, geological hazards, and paleontology. It is also the explanation of physical geography, a field that concerns itself principally with the descriptive mapping of landscapes. If geography is the house in which regional culture makes its home, then geology is its basement, plumbing, and wiring.

In the United States today, geology is most often associated with the parched and mountainous landscapes of the American West where the rocks are plainly visible and where the dynamic forces responsible for these rugged landscapes are self-evident. But geology is just as important in New England, though the rocks are less visible in this vegetated, well-watered region.

Although broken into countless towns, New England is unified as a region by its geology. Its bedrock is mostly the exposed crustal root of an ancient mountain system that developed between 300 and 500 million years ago and was continuous with mountains in Britain. The crest of the former mountain range bisects New England in a sweeping curve that begins at the Connecticut shore, extends north-northeast to the White Mountains of New Hampshire, and then northeast to the highlands of Maine beyond Mount Katahdin. The Hudson-Champlain lowland defines the western edge of this ancestral range. The sandy archipelago from Long Island to Nantucket marks its southern limit as the moraine-studded edge of the coastal plain.

The Dutch and French were limited to the western and northern margins of this crustal block, respectively. Conversely, the British colonies of this region were unified, in part, by the unified geology.

New England is the daughter country of old England. The success of settlement was due in part to the similarity between old and new worlds, places on opposite Atlantic shores where the climate, soils, streams, coasts, and stones were similar. The preconditioning of early British immigrants to America was due to the common geological history between the two places. Previously united as part of the same mountain range on the supercontinent Pangaea, England and New England were rifted apart and then drifted apart as the Atlantic widened between them.

Early New England settlements were almost exclusively along the coast and tidewater rivers because of safe harbors, a rich fishery, and rich estuarine soils. The typical harbor lies behind a resistant, glacier-scoured, wave-beaten headland flanked by a sandy beach on one side and a broad tidal inlet on the other, providing both access to and protection from the stormy Atlantic. The fishery was rich because it lay above the famous offshore banks (Georges Bank in particular) that were formed by the submergence of the glaciated portions of the continental shelf, the boulder-studded details of which provided habitat for fish, especially cod. Meanwhile, the coastal estuaries and marshes near shore that were nurseries for the marine food web were created by stream responses to a rise in sea level.

Early colonists also explored inland, hoping to find great mineral wealth, but were quickly disappointed. Except for some fairly restricted deposits of iron and copper ore, and localized mines of garnet, graphite, and mica, the region is generally without concentrated mineral wealth. The same was true for its energy resources. Hence, the New England industrial economy became and remained principally

dependent on hydropower manufacture, rather than on mineral or fuel extraction. The one exception to this trend was the deep underground mines in Cheshire, Conn., which produced most of the national supply of the mineral barite, used principally as a thickener for the white paint on so many early American clapboard houses. The ubiquity of building stone facilitated hydropower development by providing erosion-proof materials for mill-dams, canals, and foundations.

New England's three largest metropolitan areas—Boston, Providence, and the corridor between New Haven, Conn., and Northampton, Mass.—developed in geological basins where the rocks were softer and more deeply eroded than adjacent terrains. The same is true for the basin from Newark, N.J., to New York City, which lies at the southwestern corner of the region. Areas of soft rock and low topography connected with the broadest bays and largest rivers, giving room for the economic and demographic expansion of urban New England. Other weak spots in the earth's crust helped align the grid of early canals, railroads, and auto turnpikes.

The economic power that drew farmers inland from rivers and coasts was the suitability of the terrain for an agricultural economy dependent on livestock grazing, and to a lesser extent tillage fields and orchards. The success of this effort was largely due to the underlying layer of glacial hardpan, technically called *lodgment till*. This compacted, silty, stony layer prevented the downward percolation of rain and snowmelt, creating year-round moist soils and abundant springs. New England's legendary rolling hills are glacially streamlined accumulations of this substance, which also contain glacially scattered stones. Hence, the iconic image of rural New England—stone walls on gracefully curved hillsides—is a result of glacial action that simultaneously smoothed the surface and dropped a load of stones. The small size of New England fields and their exaggerated stoniness derive from glacial action as well.

The tradition of town rule is related to the spatial detail, or texture, of the landscape. In New England, the bedrock grain runs generally from the south-southwest to the north-northeast. Belts of strong and weak rock create ridges and valleys along this trend, respectively. In contrast, the glacial grain runs from north-northwest to south-southeast and is responsible for deepening the valleys and streamlining the hills in that direction. The intersection of these two grains yielded an inland landscape partitioned into thousands of small topographic "cells," each surrounded by fairly narrow valleys. With locally dramatic relief between upland and lowland, and with

streams running anything but straight, travel was rendered difficult, especially east to west. This reduced the scale of human communities, which eventually coalesced into hundreds of towns.

Although later eclipsed during the era of Manifest Destiny, New England was a place of exciting developments in geology and natural history, particularly during the early 19th century. The discovery of natural curiosities—fossilized footprints, plant fragments, and fish and dinosaur bones in the Connecticut River valley—by Reverend Edward Hitchcock of Amherst College helped lay the groundwork for evolutionary theory. The discovery of unusual minerals and lava flows by Benjamin Silliman of Yale University helped create the discipline of geology as the marriage of natural history and crystal chemistry. The prominent moraines, erratic boulders, and “boulder-clay” of Cape Cod and the islands allowed Louis Agassiz of Harvard University to extend his glacial theory from Europe to North America. In fact, the rise of New England culture coincided with the emergence of geology as a discipline, a time when the region’s leading intellectuals—Timothy Dwight, Noah Webster, Ralph Waldo Emerson—were giving the natural landscape as much attention as they had previously given to the ecclesiastical landscape.

Geology, the meat and bones of science, gave natural history the depth of time and the universality of process that would help transition European Calvinism into American Transcendentalism. The story of Pliny Moody, a farmer from Hadley, Mass., is a case in point. In 1802 he discovered enormous three-toed footprints in the Jurassic red sandstone of the Connecticut River valley. At the time, they were interpreted as the tracks of Noah’s raven. Two decades later, these same tracks, together with what we now know to be dinosaur bones, were being properly interpreted as vertebrate fossils. The connection between geology and visual art was important as well, particularly in the case of the Hudson River School and the American impressionist movement, most of which developed along or near the New England coast. Rock headland, sandy shore, meadow and marsh, bouldery streams, conifer forest glades: all are beautiful, and all are geological phenomena characteristic to the region. All have become fused with its identity. The soul of New England perches on a rock.

In an era before widespread use of fossil fuels, the hydropower resources of the region assured the industrial success of New England. The flow of meltwater at the base of the glacier diverted preexisting streams to positions where they were forced to flow over hard-rock

ridges, producing narrow reaches with small waterfalls that were easily exploited as sites for millponds and mills. In places where the bedrock was less resistant, however, glacial action broadened and deepened preglacial stream courses, later filling them with deposits of sand and gravel that became important aquifers. The combination of easy-to-exploit narrows and the steady flow from aquifers yielded nearly ideal conditions for mills at the scale of small villages. The same was true for New England’s larger rivers—especially the Merrimack and the Connecticut—which had the added advantage of negligible down-valley gradient between developed mill sites.

The growth of the interstate highway system and the straightening and shortening of earlier road networks have, ironically, made geology more visible than at any time in the past. Thousands of road cuts, each an artificial canyon, provide views of the stony viscera that lie beneath the earth’s surface. The typical views are either of massive granites or marbles or of tightly banded gneisses and slates, many of which are cut through by veins and shattered into jagged blocks. These rocks were formed deep within the roots of the former New England mountain ranges, where they were transformed by metamorphism. The fractures speak of the cooling and decompression experienced by the earth’s crust as it rose upward during eons of erosion. The survival of such ledges against the onslaught of one ice age after another is testament to the strength of this land. Conversely, the artificial exposure of these rocks is testament to the power of petroleum and the ingenuity of material scientists and mechanical engineers. These canyons proclaim the notion that human beings have, during the past half century, become the most important geological agent operating in the region.

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Robert M. Thorson