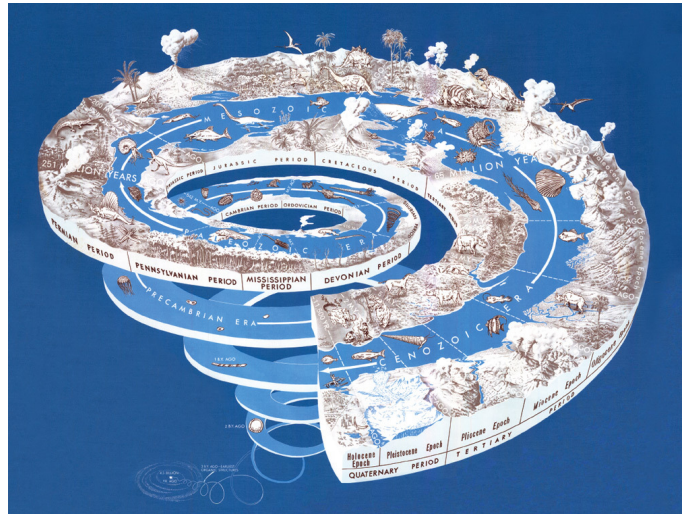


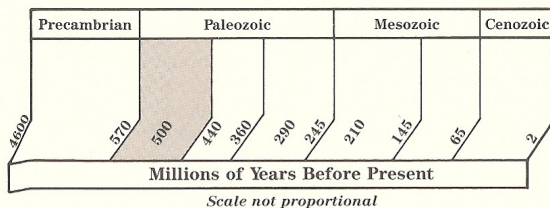
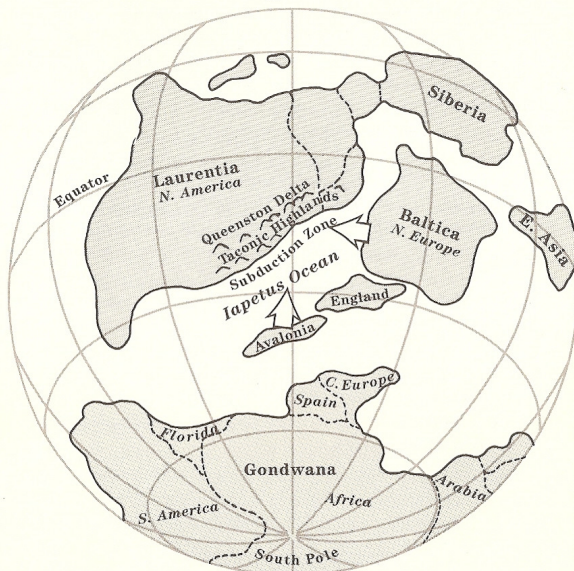
The Avalonia Land Conservancy is named after the geological land mass that comprises southeastern Connecticut. The Avalonia terrane, as it is called, has a deep time history that is described in two books that are excerpted below. The first is **WRITTEN IN STONE: A GEOLOGICAL HISTORY OF THE NORTHEASTERN UNITED STATES**, ©1989 by Chet Raymo and Maureen E. Raymo and the other is **STONE BY STONE: THE MAGNIFICENT HISTORY IN NEW ENGLAND'S STONE WALLS**, ©2002 by Robert Thorson.



WRITTEN IN STONE

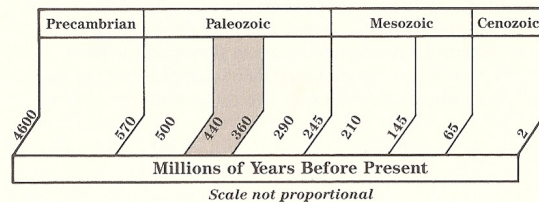
Chapter Four

The Taconic Upheaval



Chapter Five

Exotic Terranes, Green Terrain



As Baltica approached and finally collided with Laurentia, one last terrane was added to New England, probably the most mysterious of all. The terrane is called Avalonia, after the Avalon Peninsula in Newfoundland, which is part of its domain. A strip of the Maine coast south of Bangor, from Boothbay Harbor to the Canadian border, is part of Avalonia. So too is eastern Massachusetts and all of Rhode Island. It is not entirely whimsical to say that Boston is the capital of Avalonia.

Controversial paleomagnetic evidence suggests that Avalonia drifted to its present position from as much as a thousand miles farther south. Other evidence implies affinities between Avalonian and African rocks. We know that Avalonia arrived here from somewhere far off, but no one is quite sure from where. Avalonia may have been a submerged plateau in the Iapetus Ocean, caught in the crunch when Baltica and Laurentia collided. Boston's slab of Avalonia was plastered onto North America about 400 million years ago, when North America itself was still south of the equator. Since that time, the Avalonian rocks have been crunched and shattered, intruded by volcanics and overlaid by sediments, but they have retained an identity that is entirely different from that of their neighboring rocks to the west. Part of the western boundary of Avalonia is the Lake Chagoggagoggmannauggagoggchaubunagungamaugg Fault, a geological feature with a name as exotic as the terrane it defines. The fault takes its name from a lake in Massachusetts near the Connecticut border; the Indian name of the lake means "You fish on your side, I fish on my side, nobody fishes in the middle — no trouble."

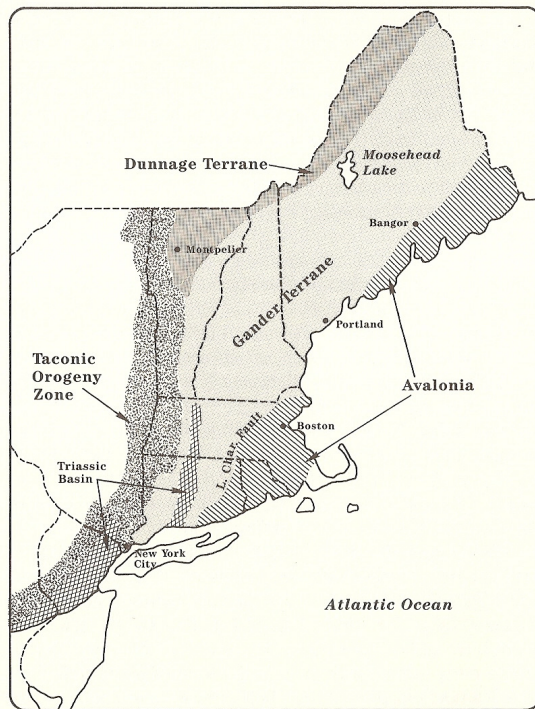


FIGURE 5.1—The terranes of the Northeast east of the Taconic orogeny zone were added to North America as the Iapetus Ocean closed.

Trilobite fossils found in outcrops at Braintree and Quincy, Massachusetts, are also found in the Carolinas, the Canadian Maritime Provinces, southern Ireland, and parts of England and Wales — but nowhere else on Earth. These places are all part of one suspect terrane, once presumably united, now broken and dispersed. The temptation is powerful to think of these dispersed Avalonian fragments in the same way as those slivers of Wrangellia scattered up and down the mountain ranges in the West. The Braintree trilobites are of a species known as *Paradoxides*. *Paradoxides* is indeed a paradox — an exotic, suspect traveler that came with Avalonia from an uncertain far-off place. *Paradoxides* was one of the biggest Cambrian trilobites, reaching several feet in length. The metamorphosed slab of sea floor which was that trilobite's domain docked against Massachusetts in Devonian times, and it has been here ever since. Where it came from, no one knows.

When at last Baltica and Laurentia collided, Avalonia was caught in the crunch, like an automobile caught in a head-on collision between two freight trains. Even as the collision was occurring, the continents were drifting closer to their present positions on the globe. North America (Laurentia) was slipping northward

across the equator, and pivoting into the more familiar north-south alignment. Northern Europe (Baltica) was drifting even more rapidly from far southern latitudes, and moving into position to dock with Laurentia. Siberia, and the flotilla of continental fragments that would become the rest of Asia, were drifting westward toward eventual collisions that would assemble that continent; when Siberia at last collided with Europe it would raise the Ural Mountains. Meanwhile, the southern part of the globe was dominated by a great supercontinent, Gondwana, which embraced the present land masses of South America, Africa, India, Australia, and Antarctica. Florida, too, was at that time part of Gondwana.

When, in the Northeast, the decisive crunch came, and Baltica and Laurentia collided, the exotic terranes that had already docked with Laurentia were crumpled and metamorphosed. Masses of molten material were injected into the debris. A towering mountain range was again raised across the Northeast, and indeed all along the suture between the two continents.

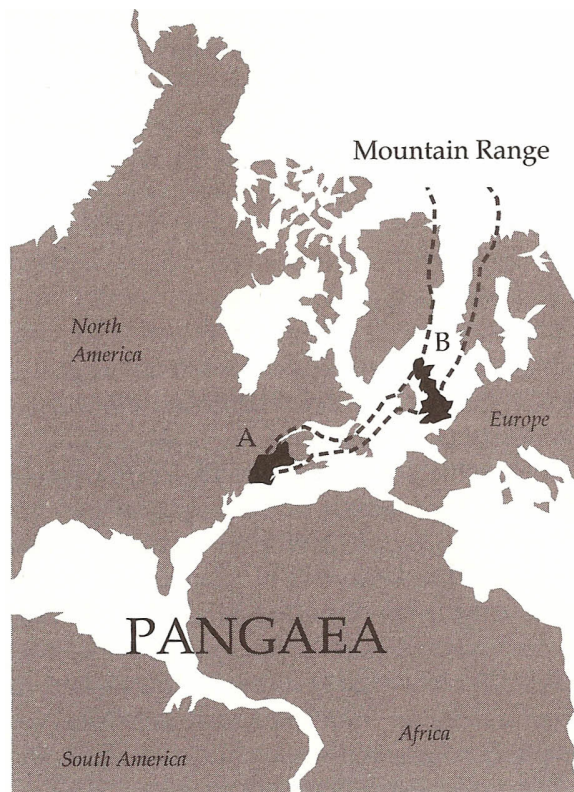
STONE BY STONE

Life began about four billion years ago, probably on some hot, briny, pitch-black, undersea volcanic vent. From that remote bacterial beginning, the evolution of life commenced. For most of Earth history, however, life would remain simple and confined beneath the sea. Only after ninety percent of Earth history had passed would creatures evolve legs and become strong enough to live on land. It was during this life transition — from oceanic slime to terrestrial animals — that the raw material for the stones of New England began to form.

This inception took place in the Iapetus Ocean, the precursor to the Atlantic, which occupied roughly the same place; Iapetus was the mythological father of Atlas, for whom the Atlantic is named. The Iapetus Ocean disappeared as the ancient landmasses of Africa, Europe,

and North America converged upon each other during the formation of Pangaea. The former ocean's water could easily flow elsewhere on Earth. But the solid material that had lain between the three continents — abyssal marine mud, plankton oozes, volcanic islands, old shorelines, limy reefs, small blocks of crust, and other earthly flotsam — was scraped off the floor of the ocean and added to the edge of North America, which at that time lay much farther south, near the equator.

The culmination of this continent-to-continent collision occurred about three hundred million years ago, shortly before the dinosaurs began to rule the planet. Called the Acadian Orogeny in New England and the Caledonian Orogeny in Britain, it produced a mountain range that traced a seam through the center of Pangaea, where the continents had been stitched together. Indeed, the fjord-torn mountains of Norway shared the same bedrock with Greenland; the central Appalachians were attached to West Africa. The lands in between — New England, maritime Canada, and Britain — were pressed



Acadian-Caledonian
Map of Pangaea showing New England (A)
and Old England (B).

tightly together during the three-way collision.

A small fragment of continental crust geologists call Avalonia, caught up in this

collision, has since broken into separate pieces. One now lies beneath southeastern England, another beneath southeastern New England. On the other side of the collision lay what is called the Greenville Terrane, which later broke up as well; its rocks form the northwestern part of the British Isles, including Scotland, and the northwestern edge of New England from western Connecticut to western Maine. Most of what lies between — Ireland, central England, and Wales on one side of the Atlantic and most of central New England on the other — was made from the mud and clay of the Iapetus Ocean.

Any land caught in the collision zone and squeezed horizontally by the relentless tectonic stresses was also thrust vertically upward, producing a mountain range so massive that it couldn't be supported by the strength of the Earth's crust alone. Hence, the vast bulk of the mountain range, extending from Florida to northern Norway, sank deeply into the softer mantle of the Earth, in places as much as twenty miles. Essentially, only the upper part of the mountain chain remained above the ocean while most of it lay well below sea level, as though it were an enormous stone iceberg. (Something similar is happening in the Himalayas today, where the ongoing collision between India and Asia has produced a range of mountains made by materials scraped off the floor of a disappeared ocean. The Himalayas above sea level today are but a small fraction of their total mass underground.)

It was in the root of the "Acadian Mountains," whose eroded stubs are now the northern Appalachians, that New England's stones were created ten to twenty miles straight down. A dry, hot melange of minerals baked slowly within the Earth, at a depth more than five times that of the deepest mine. Temperatures sometimes exceeded that of flowing lava. Pressures were thousands of times greater than those above ground. Briny waters were forced out of pore spaces as they squeezed shut, carrying with them gold, silver, mercury, and other precious metals dissolved in boiling fluids. Carbon, nitrogen, hydrogen, and other lighter, volatile elements that had originally been extracted from the Earth's atmosphere by biological processes and sunk to the ocean floor burned away and were vented back to the skies. Primary rock-forming elements — silicon, oxygen, aluminum, calcium, sodium, iron, potassium, magnesium — were left behind and forced to recombine into new minerals that were stable under these new conditions. Clay cooked to mica, grit into quartz. Enormous masses of rock the size of Rhode Island and rendered soft by the heat stretched and bent like taffy, folding into each other, miles below the surface.

Over time, the once mundane materials of the former Iapetus Ocean — mud, muddy sand, sandy mud, sand-were transformed into the beautiful banded rocks visible over most of New England today. Some of these rocks are layered like a cake. Others resemble succotash, with clots of crystals. Some of the manufactured minerals would become vital to early Yankee industry — pink feldspar for ceramics, smoky quartz for glass, brown garnets for abrasives, white barite for paint thickener, bronze sheets of mica for furnace windows, green talc for lubricants, gray veins of graphite for pencil lead, and black specks of iron oxide for steel. Colonial mining was a colorful, and locally successful, business.

The color of stone is also controlled by the geology. Near the edge of the Connecticut River Valley, the stones have the rich brick-red to maroon-brown color of the Jurassic deserts in which they were deposited; these were rocks from the rift basin. In Vermont, black slate is infused with white quartz veins, giving some of its walls a zebra-like appearance; these were rocks from Iapetus. Walls in southeastern Connecticut and Rhode Island are pinkish, owing to the abundance of rose-colored feldspars in its granite; these are the ancient rocks of Avalonia. Large areas of northeastern Connecticut and central Massachusetts contain rocks that are rich in iron-bearing sulfurous minerals (pyrite, pyrrhotite, chalcopyrite) that rust strongly when exposed to the air, giving rise to yellowish-red stains that drip downward on the surface of otherwise light-colored rock; even quartz boulders are tinted orange. Most of the walls north of Narragansett Bay, Rhode Island, are dark gray in color, the neutral hue of the dirty, volcanic, sedimentary sandstone from which they were built. These walls sometimes contain fragments of coal and blackened fragments of plant fossils, speckling the otherwise dull color.