



# Geologic History

## Exotic Terranes: *the making of New England*

Due to their origin from far away, 'exotic' places, **exotic terranes** have distinctly different geologic characteristics than the surrounding rocks.

**Exotic terranes** are not exclusive to New England. Florida is a good example of an exotic terrane, originating as part of Gondwana. Parts of the West Coast of North America (including Alaska) are also considered to be exotic terranes, sutured on to the coast and repositioned by strike-slip faults (shearing of blocks of crust).

Until the Ordovician period, North America was missing most of what we know of today as New England. Formed over hundreds of millions of years, New England was slowly pieced together by the addition of several tiny strips of land to the proto-North American continent. These strips of land are called '**exotic terranes**,' small landmasses that originated from somewhere other than North America and were tacked on to the continent as plates converged. Cameron's Line marks the ancient suture line between proto-North America and the exotic terranes of New England. Over several million years, two exotic terranes were added to proto-North America: the Iapetus Terrane and the Avalonia Microcontinent (Figure 1.10).

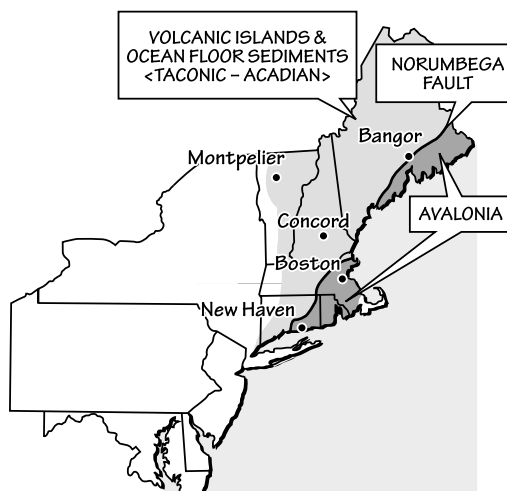
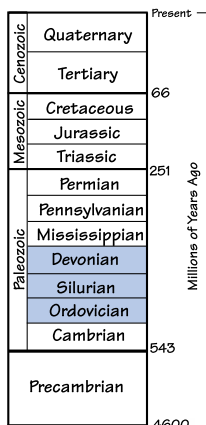
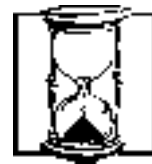


Figure 1.10: New England was not always part of the North American continent. Slices of land known as exotic terranes, collided with North America during the Taconic and Acadian orogenies. Figure by J. Houghton.

During the Taconic mountain-building event, volcanic islands had formed in the Iapetus Ocean, at the subduction zone of the plates carrying North America and Baltica. As the plates merged, the dense oceanic crust of the Iapetus Ocean was pulled down into the mantle where it melted. Some magma from the melting, subducting oceanic crust, rose back up through the plate to form the volcanic islands. Weathering and erosion of the volcanic islands produced sediments that were then deposited in the Iapetus Ocean. The volcanic islands drew closer and closer to proto-North America as the oceanic crust was subducted. Eventually, the volcanic islands were pushed onto the eastern margin of North America, along with sediments that had been eroded into the ocean basin from proto-North America and the volcanic islands. The Iapetus Terrane, including the string of volcanoes and associated





ocean basin sediments from the Taconic mountain-building event, added most of Vermont, New Hampshire, central Massachusetts, Connecticut and Maine to the Northeast.

The exotic terrane Avalonia was a microcontinent, originating from the African plate (Gondwana) in the south and traveling northwards on the moving plates to collide with North America. When the Iapetus Ocean closed in the

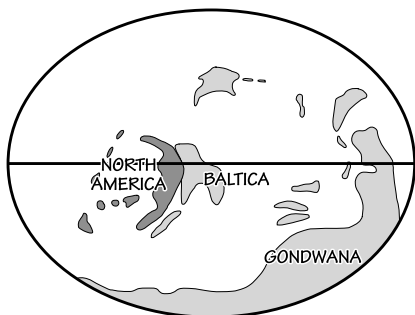


Figure 1.11: Silurian: 425 million years ago.

Devonian, Avalonia was sutured to the East Coast in between the colliding continents of Baltica and North America. Avalonia tacked on the last main bits of New England, including eastern Maine, Connecticut and Massachusetts, and Rhode Island. Only Cape Cod, Long Island and smaller **islands** off the coast of New England were yet to be part of the Northeast.

The Iapetus and Avalonia Terranes that make up New England were added to the Northeast over millions of years during the Taconic orogeny and the later Acadian orogeny (when North America collided with Baltica) from the Ordovician through the Devonian (Figure 1.11). The terranes were squeezed, crumpled, deformed and intensely metamorphosed. This has made for some rather complex geology in the New England area. The intensity of deformation and metamorphism has made it difficult for geologists to distinguish the individual volcanic islands added to the margin of North America or the exact timing of exotic terrane collisions.

The **islands** off the coast of New England did not form until millions of years later during the Cenozoic, as the Northeast was in the grip of the Ice Age. The enormous amounts of material dumped by glaciers as they melted and retreated North created these island landmasses.

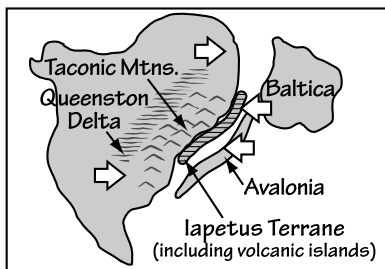


Figure 1.12: Exotic Terranes

- Taconic volcanic island arc collides with North America
- Iapetus Ocean sediments collide with North America
- Avalonia (origin uncertain) collides with North America

Cenozoic	Quaternary	Present
	Tertiary	
Mesozoic	Cretaceous	66
	Jurassic	
	Triassic	
Paleozoic	Permian	251
	Pennsylvanian	
	Mississippian	
	Devonian	
	Silurian	
	Ordovician	
Precambrian	Cambrian	543
	Precambrian	
		4600

