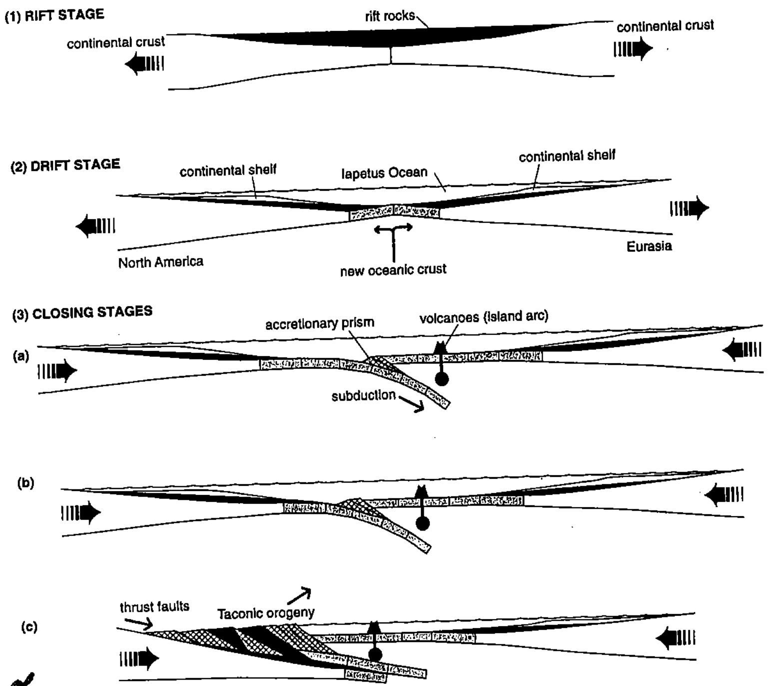

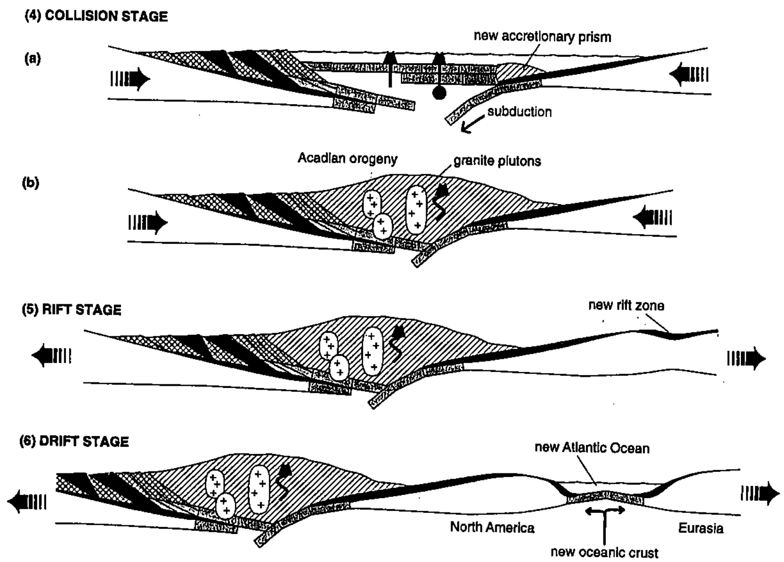

Origin of Vermont's Mountains. The diagrams illustrate the probable origin of the Appalachian Mountain system, including the Green Mountains of Vermont, and other deep-rock formations in the state. There have been at least three "Appalachian Mountain" systems in this region of the continent. The earliest we have evidence of—called the Grenville Mountains—was formed over a billion years ago, when continental collisions (predating Pangaea by some 800 million years) created mountains perhaps rivaling the present-day Himalayas in height. These mountains largely eroded away over the hundreds of millions of years, with the Adirondacks and portions of the southern Green Mountains the only remnants left. The diagrams pick up events beginning at that stage. See text for more complete explanation; mybp = millions of years before present. Sizes of features and distances are not to scale.

(1) Rift stage (late Precambrian to early Cambrian, 590–550 mybp). The ancient North American continental crust rifts (stretches, thins, and subsides), creating broad, deep valleys. The valleys fill with fluvial (water-borne) sediments from the adjacent uplands. Volcanoes are common in the New England region.

(2) Drift stage (early Cambrian to middle Ordovician, 555–440 mybp). The two continental masses "drift" apart, with subsidence between them increasing and the new Iapetus Ocean filling in between. A mid-ocean ridge supplies new ocean crust on either side. The Grenville Mountains continue to erode, with sediments accumulating on the shelves at the edge of the continents.

(3) Closing stages, or Taconic orogeny (middle to late Ordovician, 440–430 mybp). (a) The Iapetus Ocean ceases to grow, with the continents beginning to move toward each other. The western crust plunges (is subducted) under the eastern continental crust as the continents converge. (b) The leading edge of the eastern mass acts like a bulldozer to scrape up sediments, ocean crust, and, eventually, continental crust, and pushes them into huge wedges (accretionary prism). (c) With increasing height, pressure, and heat, sediments and rocks in the prism undergo metamorphism. Thrust faults also develop. Finally, the prism—now the Taconic Mountains—is pushed up against the Adirondacks. An island arc of volcanoes, called the Bronson Hill formation, develops east of this zone, in the region of present-day New Hampshire.

(4) Collision Stage, or Acadian orogeny (middle Devonian, 360–345 mybp). (a) A new spreading center east of the present-day Green Mountains creates a long basin the length of New England and Gaspé Peninsula (called Connecticut Valley–Gaspé Basin), after which a new deep-ocean trench develops on the eastern side of what is left of the Iapetus Ocean, plunging to the west. The continents converge once again, with what will become eastern New England part of the leading edge of the eastern continental mass. (b) The collision. The eastern continental mass collides with the Taconic Mountains, with the sediments and rocks uplifting and metamorphosing into the Green Mountains. Melting and subsurface igneous (magma) activity continue under the crust, creating granite deposits (e.g., Barre). Pangaea is formed and will remain intact for 145 millions years.

(5) Rift Stage (Mississippian–lower Triassic periods, 345–200 mybp). Pangaea begins to pull apart. The North American plate rifts east of the Green Mountains, with subsidence and thinning of crust.

(6) Drift Stage (lower Triassic–present, 200 mybp–present). Pangaea splits apart. Eastern North America separates from Eurasia-Africa along the present-day east coast, as the Atlantic Ocean is born. The new mid-ocean ridge supplies ocean crust as the continents move away from each other. Over the last 200 million years, the Green Mountains may well have eroded down to half their original height.

Map by Barry Doolan, adapted by Brian MacDonald, from "The Geology of Vermont," *Rocks & Minerals*, July/August 1996 (vol. 71, no. 4).

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