

## THE ORIGIN OF THE APPALACHIAN MOUNTAINS

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Many years ago when the Appalachian Mountains were named, no one realized that these mountains comprised only a fragment of the original mountain structure as it was geologically constructed 300 million years ago. We must now look to the far side of the Atlantic Ocean to find the other fragments. So where are the other fragments and how did this long mountain chain come about?

Over the last 50 years we have discovered that the earth's "skin" is made up of a dozen or so large (and some small) polygonal plates. We don't really see these plates because they are covered with: (1) continental crust, i.e. the continents, which may be as much as 35 km thick under mountain ranges, and (2) oceanic crust which is only a few kilometres thick but has resting on it a very thick layer of sea water.

We have also discovered that these plates are continually re-shaping themselves: growing on some edges with new magma from below (e.g. the Mid-Atlantic Ridge), or slipping under the edges of other plates (e.g. along the coast of Chile), or sliding laterally past one another (e.g. through Port-au-Prince, Haiti). All of these involve massive movements of crustal material, some of which express themselves as earthquakes when they happen suddenly.

So, as the plates morph into different shapes, the continents which ride on top seem to move very slowly - or "drift" - across the earth's surface. Although these processes have gone on for at least 4 billion years - and continue to do so - to form numerous mountain ranges elsewhere, we will now only describe those that apply to the Appalachian Mountains and their related cousins.

By about 550 million years ago the continents that we now know as North America, South America, Africa, and Europe - in those days they had somewhat similar shapes - were separated by the Iapetus Ocean, which very loosely might be likened to our Atlantic Ocean. These ancient continents each had their own mountains which were continuously being eroded and depositing their sediments off-shore. Over millions of years, these sediments formed small "bits" of continents. The northern coasts of South America and Africa were particularly prolific in developing these micro-continents.

By about 450 million years ago the four ancient continents began to "drift" together, taking another 50 million years before they collided. In effect, the three non-North American plates with their thin oceanic crust slipped beneath the margin of the North American plate until the continents riding on top came together and collided, squashing the micro-continents between them. Because continental crust is very thick, the continents could not slip beneath but were rather smashed together to form a massive continent we now call Pangea. The resulting collision zone formed great folded masses extending both downward deep into the plates and upward into majestic mountains. At least four of the squashed micro-continents now comprise much of the Atlantic Provinces.

By 300 million years ago this huge mountain range - containing some mountains as high as the present Himalayan Mountains - extended essentially along the equator to form what is now northern Florida, through New England, the Atlantic Provinces, western Spain, Ireland, Scotland, and Scandinavia. (See Figure, courtesy AGS: "The Last Billion Years")

By about 200 million years ago most of these continents had drifted apart because fresh magma had begun to rise between the plates on which they were sitting and forcing them apart. The linear North Mountain basalts in Nova Scotia which extend sub-sea to the eastern coast of New England is evidence of an initial, though unsuccessful attempt of the continents to split.

Continuing into the present these mountains, although no longer active in any catastrophic sense, have been slowly eroding and depositing their sediments off-shore just as it happened many millions of years ago - and so the cycle goes on. The slow separation of the continents - at about the rate our finger nails grow - have resulted in the various pieces of this once huge mountain range becoming significant mountain ranges in the countries now surrounding the Atlantic Ocean. We can now enjoy hiking and climbing the gentle slopes of the Appalachian Mountains and know that our cousins elsewhere are not only thinking of us but understand the tremendous processes that formed the rocks beneath their feet.

Global paleogeography of the late Carboniferous, about 305 million years ago.

