How does continental drift prove the theory of plate tectonics

Continental Drift as proposed by Alfred Wegener was theory that all of the continents had once been connected as part of a super continent he called Pangea. Then some (at the time) unknown force spilt the super continent into pieces forming the presently observed continents. Wegener had sufficient evidence from glaciers, fossils, matching coast lines, and geological strata to prove his point. However his theory contradicted the prevailing theories of biological evolutions timeline and geological column, the geosyncline mountain, and sedimentary layer formation, uniform processes in geology, (uniformtarism) His theory postulated a recent rapid separation of the continents. His theory lacked a mechanism or force that could account for the rapid movement of the massive continents. Plate tectonics is Wegener theory of continental drift reworked. The force needed to move the continents is proposed to be convection currents in the mantle. Geologist have a much better understanding the structure of the earth, in terms of the crust, and mantle than was available in Wegener's time. The rate of expansion of the continents has been modified to not offend the idea of slow uniform processes. The evolutionary timeline and geological record has been modified also to better correlate with the geological evidence of the separation of the continents. The continents are seen as part of large plates of crust that are moved by the convection currents in the mantle. During World War II submarine warfare revealed the existence of the mid ocean ridges, The symmetric magnetic bands radiating from the mid ocean ridges gave further evidence for the idea of Continental Drift. Subsequent studies of rift valleys gave proof that the crust in the rift valleys was separating and spreading apart. Given the new evidence scientists had to reexamine Wegener's Theory. The examination of the evidence gave birth to the theory of plate tectonics in place of Wegener's theory of Continental Drift. Even so some evolutionary scientists like Gaylord Simpson continued to oppose the theory of plate tectonics, into the 1970s as being contradictory to the theory of Darwinian Evolution. Today, most people know that landmasses on Earth move around, but people haven’t always believed this. It wasn’t until the early 20th century that German scientist Alfred Wegener put forth the idea that the Earth’s continents were drifting. He called this movement Continental Drift. He was not the first or only person to think this, but he was the first to talk about the idea publicly. Wegener came up with this idea because he noticed that the coasts of western Africa and eastern South America looked like puzzle pieces, which might have once fit together and then drifted apart. Looking at all of the continents he theorized that they had once been joined together as a supercontinent (which was later called Pangaea) around 225 million years ago (see Figure 4). The name Pangaea comes from the Ancient Greek words “pan,” meaning entire, and “Gaia,” meaning Earth. Pangaea is not the only supercontinent believed to have existed. Older supercontinents are also believed to have come before Pangaea. Movement of tectonic plates (Source: U.S. Geological Survey). The idea of moving landmasses seems obvious now, but Wegener’s Theory of Continental Drift (as he called it) was not accepted for many years. Why? Well, for one thing, Wegener did not have a convincing explanation for the cause of the drifting (he suggested that the continents were moving around due to the Earth’s rotation, which later turned out to be wrong). Secondly, he was a meteorologist (someone who studies weather), not a geologist, so geologists didn’t think he knew what he was talking about. Fossil Evidence One type of evidence that strongly supported the Theory of Continental Drift is the fossil record. Fossils of similar types of plants and animals in rocks of a similar age have been found on the shores of different continents, suggesting that the continents were once joined. For example, fossils of Mesosaurus, a freshwater reptile, have been found both in Brazil and western Africa. Also, fossils of the land reptile Lystrosaurus have been found in rocks of the same age in Africa, India and Antarctica. Map of fossil evidence (Source: Osvaldocangaspadilla [Public domain] via Wikimedia Commons). Plate Tectonics The Theory of Plate Tectonics builds on Wegener’s Theory of Continental Drift. In the Theory of Plate Tectonics, it is tectonic plates, rather than continents, which are moving. Tectonic plates are pieces of the lithosphere and crust, which float on the asthenosphere. There are currently seven plates that make up most of the continents and the Pacific Ocean. They are: African Plate Antarctic Plate Eurasian Plate Indo-Australian Plate North American Plate Pacific Plate South American Plate Tectonic plates (Let’s Talk Science using an image by Map:USGSDescription:Scott Nash [Public domain] via Wikimedia Commons). There are eight other smaller secondary plates as well as many other microplates which do not make up significant amounts of landmass. Tectonic plates not only move land masses (continental crust), but also oceans (ocean crust). Since the plates are floating on liquid rock, they are constantly moving and bumping against each other. This means that the sizes and positions of these plates change over time. Tectonic plates are able to move because the lithosphere, which makes up the plates, has a higher strength and lower density than the underlying asthenosphere. The solid plates above move along on the liquid rock below. You may imagine that these plates are zipping along, but in fact, they are moving VERY SLOWLY! The speed of the plates ranges from a typical 10–40 mm/year (about as fast as fingernails grow) to as fast as 160 mm/year (about as fast as hair grows). Geologists came to accept the Theory of Plate Tectonics in the late 1950s and early 1960s after coming to understand the concept of seafloor spreading. Seafloor spreading occurs on the seafloor where oceanic plates are moving away from each other (diverging). When this happens, cracks occur in the lithosphere, which allows magma (hot liquid rock) to rise and cool, forming a new seafloor. The opposite of divergence is convergence. This occurs when plates are moving towards each other. Material may push upwards (obduction) forming mountains or downwards (subduction) into the mantle. The material lost through subduction is roughly balanced by the formation of new (oceanic) crust by seafloor spreading. Volcanic eruptions and earthquakes can occur and mountains and ocean trenches can be formed when tectonic plates meet. Let’s look at some of these processes in more detail. Mountains and Volcanoes What do mountains and volcanoes have in common? They are both large, steep landforms made of rock that are formed when tectonic plates are pushed and pulled. Whether you get mountains or volcanoes depends on the type of tectonic plates and where they are colliding. To understand whether you will get mountains or volcanoes, you need to remember two things. There are two major types of tectonic plates: oceanic and continental. Oceanic plates are denser than continental plates. Let’s look at how tectonic plates form mountains and volcanoes. When two oceanic plates diverge (pull apart), undersea volcanoes are formed. Volcanoes are caused by cracks in the Earth’s crust. An example of this is the Mid-Atlantic Ridge, which extends from the Arctic Ocean to beyond the southern tip of Africa. There are so many volcanoes in the Mid-Atlantic Ridge, and they are so large, that it is considered the longest mountain range in the world. Iceland is located on this ridge. The red triangles on the picture show where there are active volcanoes. When two continental plates converge on land (collide into each other), mountains are formed. This is because both of the plates, which are similarly dense, will push up against each other, causing the rock to get all folded and bunched up. The crust in the region of a mountain is thicker than the surrounding crust. The Himalayan Mountains are the result of this type of process. Iceland is located on the Mid-Atlantic Ridge (Source: Let’s Talk Science using an image by USGS [Public domain] via Wikimedia Commons). When an oceanic plate (1) converges with a continental plate (2), the oceanic plate will move under the continental plate (subduction) because it is denser (3). The oceanic plate may go deep enough under the continental plate and into the mantle that it melts and forms magma (4). Increased pressure from beneath the Earth can build up and cause the magma to seep up through weak spots in the crust (5). Magma under high pressure sometimes comes through volcanic vents in the form of flowing lava, forming a volcanic cone (6). Subduction of an oceanic plate (Let’s Talk Science using a public domain image on Wikimedia Commons).

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