Carbon is the foundation of all life on Earth, required to form complex molecules like proteins and DNA. This element is also found in our atmosphere in the molecule carbon dioxide (CO_2). Carbon makes all life possible, is a key ingredient in the food that sustains us, and provides a major source of the energy to fuel our global economy. Just two-tenths of 1% of Earth's total carbon - about 43,500 billion tonnes - is judged to be above the planet's surface, in the oceans, on land, and in the atmosphere. The rest of the Earth's total carbon resides below the surface, with two-thirds of the total contained within the Earth's core.

The carbon cycle describes the process in which carbon atoms continually travel from the atmosphere to the Earth and then back into the atmosphere. Since our planet and its atmosphere form a closed environment, the amount of carbon in this system does not change. Where the carbon is located — in the atmosphere or on Earth — is constantly in flux. On Earth, most carbon is stored in rocks and sediments, while the rest is located in the ocean, atmosphere, and in living organisms. These are the reservoirs, or sinks, through which carbon cycles.

The movement of carbon from the atmosphere to the lithosphere (rocks) begins with rain. Atmospheric carbon combines with water to form a weak acid—carbonic acid—that falls to the surface in rain. The acid dissolves rocks—a process called chemical weathering—and releases calcium, magnesium, potassium, or sodium ions. Rivers carry the ions to the ocean. In the ocean, the calcium ions combine with bicarbonate ions to form calcium carbonate, the active ingredient in antacids and the chalky white substance that dries on your faucet if you live in an area with hard water. In the modern ocean, most of the calcium carbonate is made by shell-building (calcifying) organisms (such as corals) and plankton (like coccolithophores and foraminifera). After the organisms die, they sink to the seafloor. Over time, layers of shells and sediment are cemented together and turn to rock, storing the carbon in stone—limestone and its derivatives.

Only 80 percent of carbon-containing rock is currently made this way. The remaining 20 percent contain carbon from living things (organic carbon) that have been embedded in layers of mud. Heat and pressure compress the mud and carbon over millions of years, forming sedimentary rock such as shale. In special cases, when dead plant matter builds up faster than it can decay, layers of organic carbon become oil, coal, or natural gas instead of sedimentary rock like shale.

Carbon is released back into the atmosphere when organisms die, volcanoes erupt, fires blaze, fossil fuels are burned, and through a variety of other mechanisms. In the case of the ocean, carbon is continually exchanged between the ocean's surface waters and the atmosphere, or is stored for long periods of time in the ocean depths.