The Carbon Cycle

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The Carbon Cycle

- There are a few types of atoms that can be a part of a plant one day, an animal the next day, and then travel downstream as a part of a river's water the following day.

- These atoms can be a part of both living things like plants and animals, as well as non-living things like water, air, and even rocks. The same atoms are recycled over and over in different parts of the Earth.

- This type of cycle of atoms between living and non-living things is known as a biogeochemical cycle.

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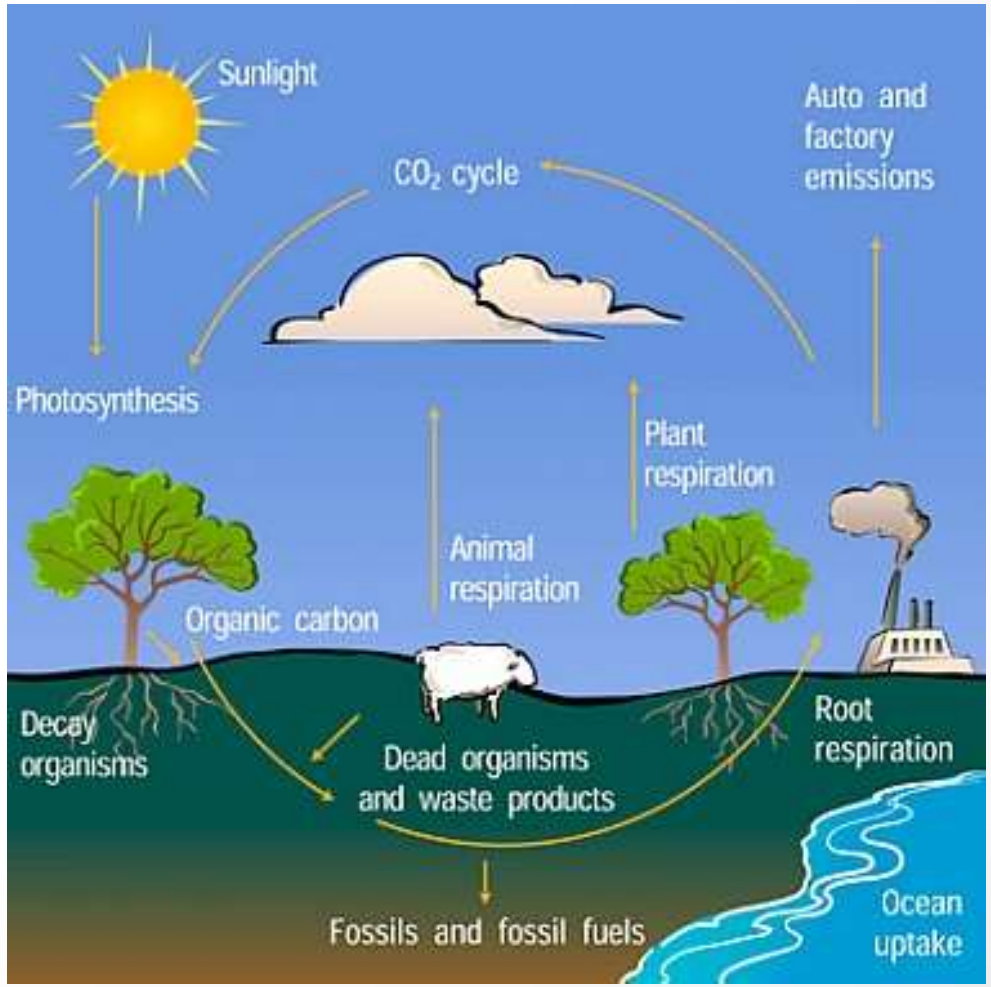
- The most common of these are the carbon and nitrogen cycles.
- Tiny atoms of carbon and nitrogen are able to move around the planet through these cycles.
- For example, an atom of carbon is absorbed from the air into the ocean water where it is used by little floating plankton doing photosynthesis to get the nutrition they need.



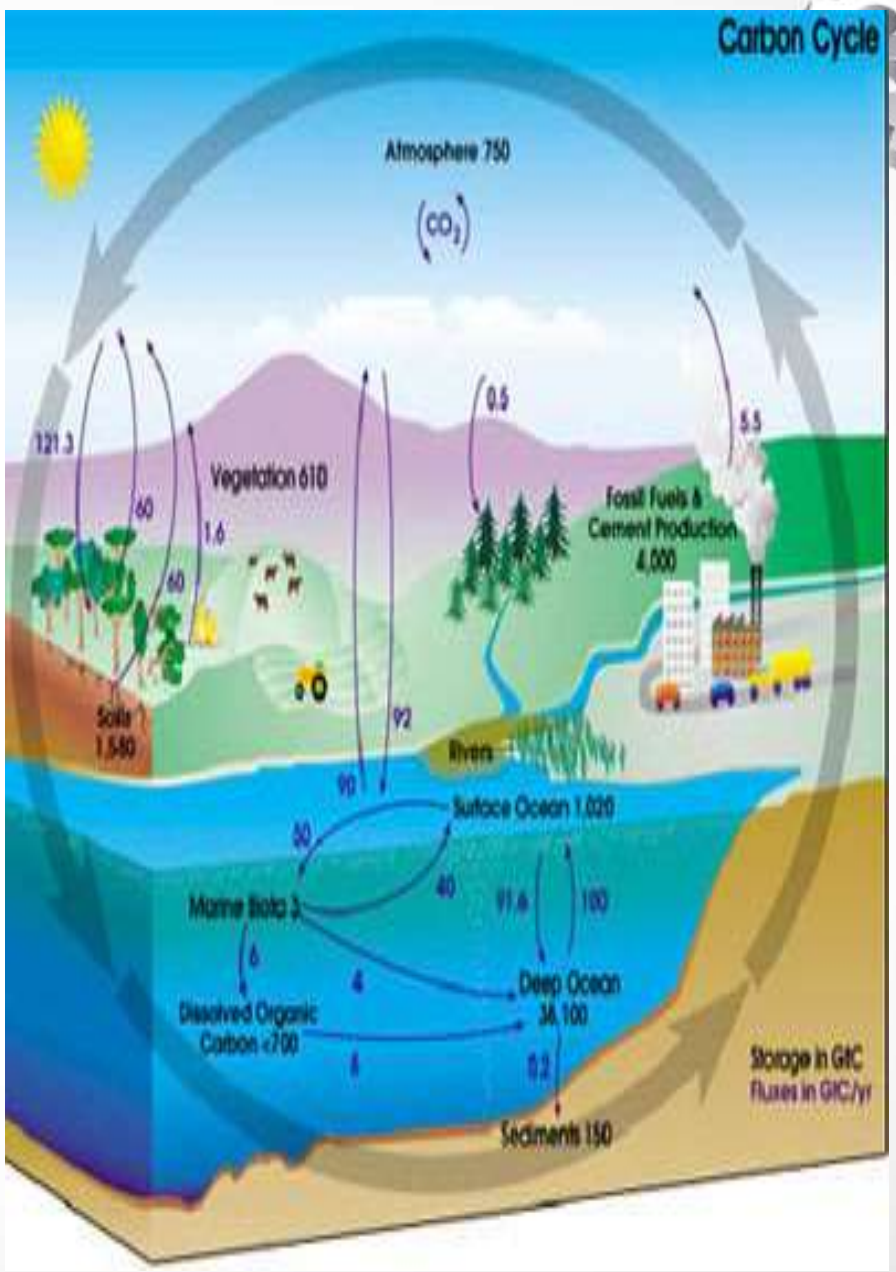
- There is the possibility that this little carbon atom becomes part of the plankton’s skeleton, or a part of the skeleton of the larger animal that eats it, and then part of a sedimentary rock when the living things die and only bones are left behind.

- Carbon that is a part of rocks and fossil fuels like oil, coal, and natural gas may be held away from the rest of the carbon cycle for a long time. These long-term storage places are called “sinks”.

- When fossil fuels are burned, carbon that had been underground is sent into the air as carbon dioxide, a greenhouse gas.

- The movement of carbon, in its many forms, between the atmosphere, oceans, biosphere, and geosphere is described by the carbon cycle.

- This cycle consists of several storage carbon reservoirs and the processes by which the carbon moves between reservoirs. Carbon reservoirs include the atmosphere, the oceans, vegetation, rocks, and soil; these are shown in black text along with their approximate carbon capacities in Figure 1.



The geological carbon cycle

- The geological component of the carbon cycle is where it interacts with the rock cycle in the processes of weathering and dissolution, precipitation of minerals, burial and subduction, and volcanic eruptions . In the atmosphere, carbonic acid forms by a reaction with atmospheric carbon dioxide

- (CO2) and water. As this weakly acidic water reaches the surface as rain, it reacts with minerals at Earth's surface, slowly dissolving them into their component ions through the process of chemical weathering.

- These component ions are carried in surface waters like streams and rivers eventually to the ocean, where they precipitate out as minerals like calcite (CaCO3).

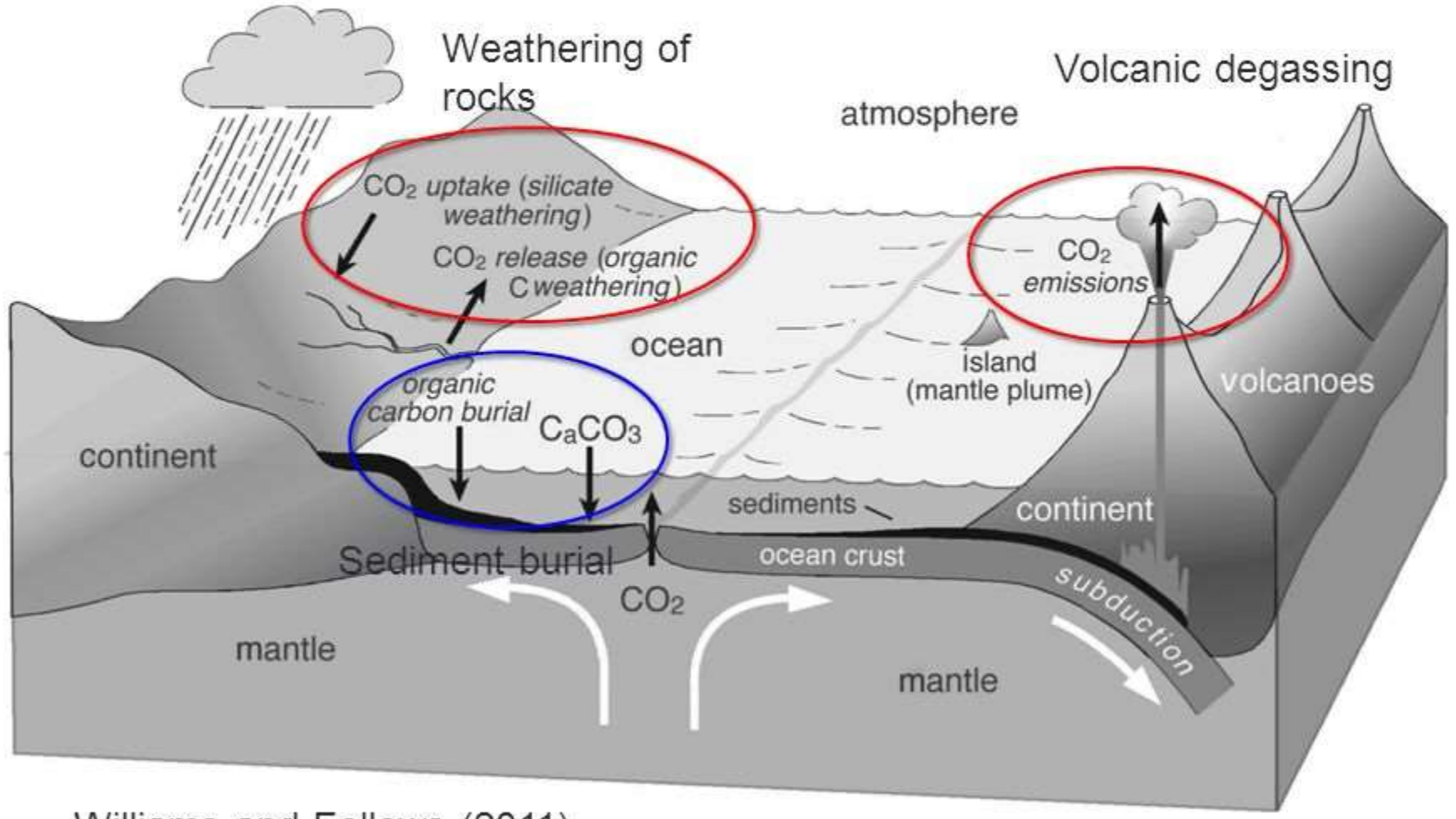
- Through continued deposition and burial, this calcite sediment forms the rock called limestone.

- The purple numbers and arrows in Figure 1 show the fluxes between these reservoirs, or the amount of carbon that moves in and out of the reservoirs per year.

- If more carbon enters a pool than leaves it, that pool is considered a net carbon sink. If more carbon leaves a pool than enters it, that pool is considered net carbon source.
- This cycle continues as seafloor spreading pushes the seafloor under continental margins in the process of subduction. As seafloor carbon is pushed deeper into the Earth by tectonic forces, it heats up, eventually melts, and can rise back up to the surface, where it is released as CO2 and returned to the atmosphere. This return to the atmosphere can occur violently through volcanic eruptions, or more gradually in seeps, vents, and CO2-rich hotsprings.

- Tectonic uplift can also expose previously buried limestone. One example of this occurs in the Himalayas where some of the world's highest peaks are formed of material that was once at the bottom of the ocean. Weathering, subduction, and volcanism control atmospheric carbon dioxide concentrations over time periods of hundreds of millions of years.

Geological carbon cycle



Williams and Follows (2011)