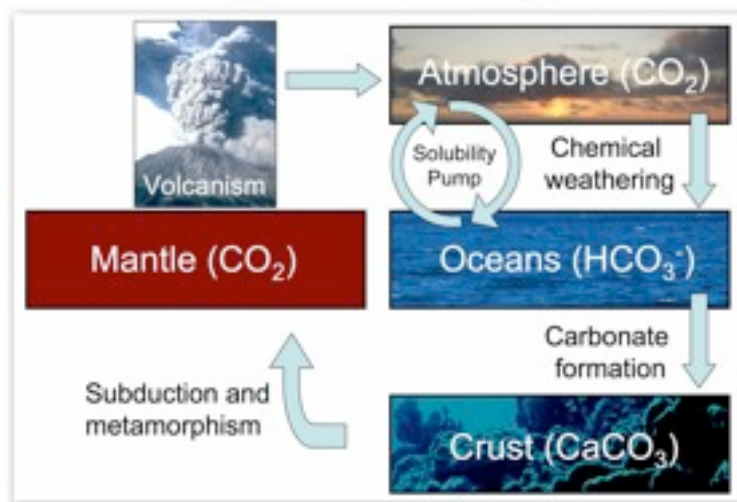


Planet Earth: An Owner's Manual

The Inorganic Carbon Cycle

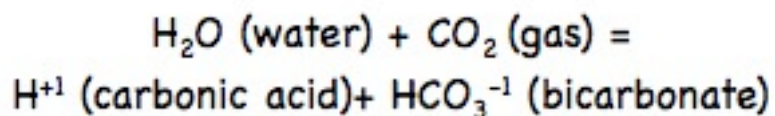


Inorganic Carbon Cycle



Carbonic Acid

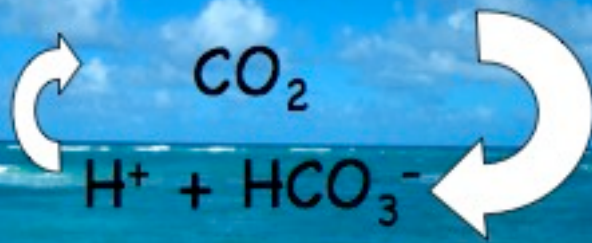
The most important chemical reaction on Earth!



Rainwater and groundwater are weakly acidic.

The alkalinity of the oceans drives the reaction to favor bicarbonate ion - this allows the oceans to store large quantities of CO₂ dissolved from the atmosphere.

Solubility Pump



The oceans are capable of storing
50X more CO_2 than the atmosphere

CO_2 dissolved in surface water is transported to
deep water by vertical ocean circulation.

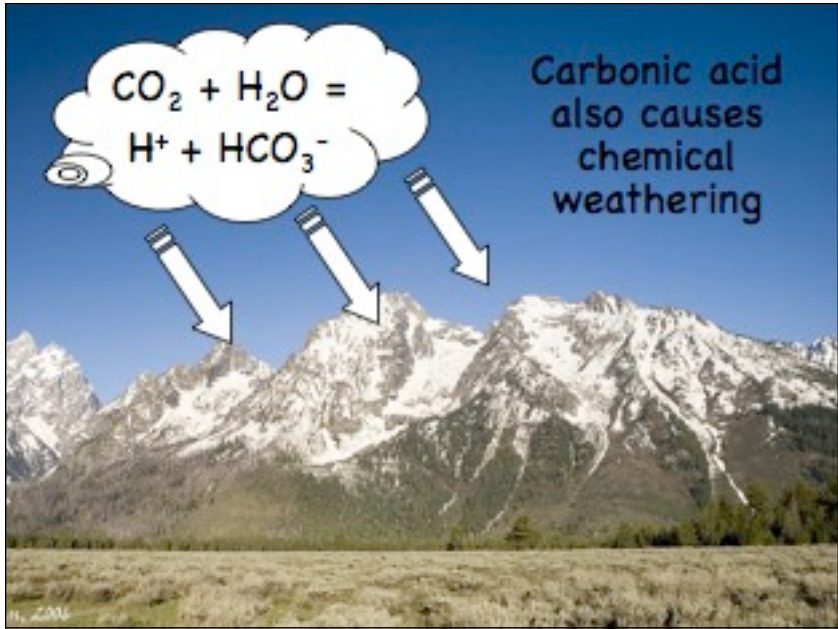
Ocean circulation conveyor belt



The ocean circulation conveyor belt plays a key role in the climate of the Earth because of the transport of energy (heat) and matter.

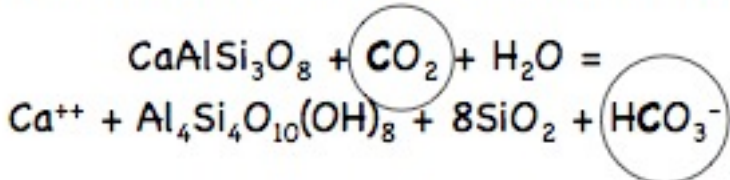
The oceans are currently absorbing about
30% of all human emissions of CO_2

- Uptake rate is limited by rate of deep ocean circulation
- As oceans warm, they will be able to absorb less and less CO_2
- As ocean waters absorb CO_2 they become increasingly acidic (pH drops - **Acidification**)
- Eventually, if atmospheric CO_2 levels begin to fall, the oceans will return their dissolved CO_2 back to the atmosphere



Hydrolysis of Feldspar

Feldspar + carbon dioxide + water =
Ca ions + clay + silica + bicarbonate ion



Follow the carbon!

Weathering feldspar in granite



Carbonate Sedimentary Rock

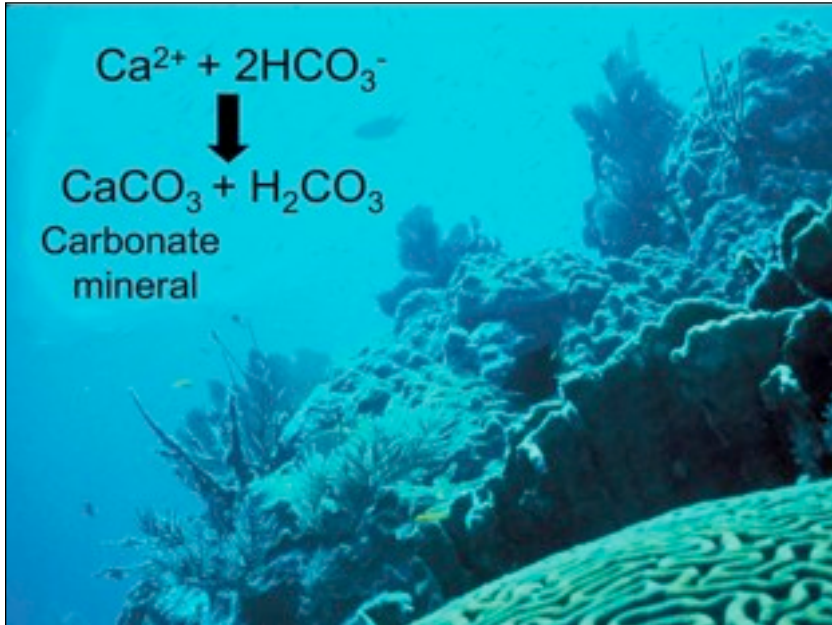
Limestone - CaCO_3

Dolostone - CaMgCO_3



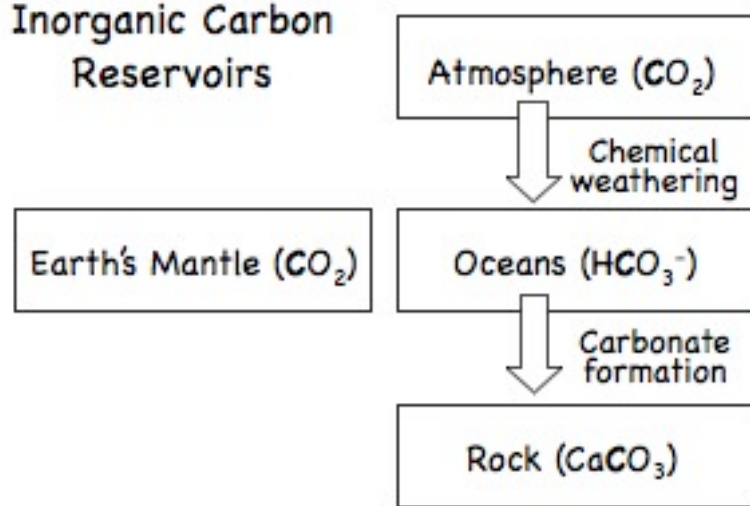
Sediments precipitated by chemical reaction of bicarbonate ion and calcium ion - usually biologically mediated.

algae, phytoplankton, zooplankton, mollusks, corals, echinoderms (sea urchins, crinoids)



A coral reef is a carbonate mineral factory.

Inorganic Carbon Reservoirs



Questions for Discussion

💡 What process on land produces the Ca^+ and HCO_3^- ions that form carbonate in the oceans?

LR

💡 What kind of climate are coral reefs found in?

RR

💡 If climate warms, will carbonate production increase or decrease?

LF

💡 As climate warms, what happens to the amount of CO_2 moving from the atmosphere to carbonate rock? RF

Inorganic Carbon Reservoirs

