



Increase in CO₂ during the Last Termination explained by a new inorganic carbon cycle.

Alastair McDonald

Wimborne, United Kingdom of Great Britain and Northern Ireland (abmcdonald33@gmail.com)

It has been known since the 1980s that as the Last Glacial Period ended carbon dioxide (CO₂) rose from ~190 ppm to 280 ppm, but the source of this carbon is still unknown. Here it is proposed that the reason why this problem is still unsolved is that the current carbon cycle models are based on outdated chemistry. For instance, many geologists and oceanographers believe that CO₂ is drawn down out of the atmosphere by silicate weathering. This idea originated in the 19th Century when it was believed that CO₂ was an acid. Now we know that acids are proton donors and that only when CO₂ reacts with water does it form weak carbonic acid (H₂CO₃). Silicate weathering is the result of the protons (H⁺ ions) from the carbonic acid increasing the solubility of the insoluble silicate rocks, with the carbon (HCO₃⁻ and CO₃²⁻) acting purely as spectator ions in those reactions.

Here a new carbon cycle is presented where:

- 1) a new reservoir, the 'aquasphere', is incorporated in the inorganic carbon system, which is the hydrosphere less the oceans, i.e. freshwater including rainwater;
- 2) CO₂ is drawn down from the atmosphere into the aquasphere by dissolution in rainwater, rather than by silicate weathering;
- 3) CO₂ is also drawn down from the atmosphere by photosynthesis, some of which is respired into the aquasphere;
- 4) carbonate weathering is a source of dissolved inorganic carbon to the aquasphere and from there to the oceans, rather than being a neutral player in the carbon system;
- 5) carbonate sediments in the ocean, which provides a major sink for inorganic carbon, are produced by biotic activity, not chemical precipitation, thus no CO₂ is generated by their formation;
- 6) the carbon sediment sink can also become an inorganic carbon source if the lysocline shoals, e.g. when oceanic pH falls or sea level rises.

With this model, it can be shown that the sea-level rise, caused by melting ice sheets, will shoal the lysocline, which explains both the source and the cause of increased atmospheric CO₂ during glacial terminations. This implies that there will be a further increase in CO₂ from the ocean sediments caused by sea-level rise when the Greenland and West Antarctic ice sheets melt as a result of anthropogenic global warming. Moreover, since ocean acidification also causes the lysocline to shoal, producing more atmospheric CO₂ in a positive feedback loop, then we may have

a repeat of the PETM (Paleo-Eocene Thermal Maximum) event when runaway global warming was caused by an increase in atmospheric CO₂.