Not Enough CO_2 in Fossil Fuels to Make Oceans Acidic: A Note from Professor Plimer

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In response to a question concerning the likelihood of our oceans becoming acidic from global warming Ian Plimer, University of Adelaide, has replied:

THE oceans have remained alkaline during the Phanerozoic (last 540 million years) except for a very brief and poorly understood time 55 million years ago.

Rainwater (pH 5.6) reacts with the most common minerals on Earth (feldspars) to produce clays, this is an acid consuming reaction, alkali and alkaline earths are leached into the oceans (which is why we have saline oceans), silica is redeposited as cements in sediments, the reaction consumes acid and is accelerated by temperature (see below).

In the oceans, there is a buffering reaction between the sea floor basalts and sea water (see below). Sea water has a local and regional variation in pH (pH 7.8 to 8.3). It should be noted that pH is a log scale and that if we are to create acid oceans, then there is not enough CO_2 in fossil fuels to create oceanic acidity because most of the planet's CO_2 is locked up in rocks.

When we run out of rocks on Earth or plate tectonics ceases, then we will have acid oceans.

In the Precambrian, it is these reactions that rapidly responded to huge changes in climate (-40 deg C to +50 deg C), large sea level changes (+ 600m to -640m) and rapid climate shifts over a few thousand years from 'snowball' or 'slushball' Earth to very hot conditions (e.g. Neoproterozoic cap carbonates that formed in water at ~50 deg C lie directly on glacial rocks). During these times, there were rapid changes in oceanic pH and CO_2 was removed from the oceans as carbonate. It is from this time onwards (750 Ma) that life started to extract huge amounts of CO_2 from the oceans, life has expanded and diversified and this process continues (which is why we have low CO_2 today.

The history of CO_2 and temperature shows that there is no correlation.

Ask your local warmer:

1. Why was CO_2 15 times higher than now in the Ordovician-Silurian glaciation?

2. Why were both methane and CO_2 higher than now in the Permian glaciation?

3. Why was CO_2 5 times higher than now in the Cretaceous-Jurassic glaciation?

The process of removing CO_2 from the atmosphere via the oceans has led to carbonate deposition (i.e. CO_2 sequestration).

The atmosphere once had at least 25 times the current CO_2 content, we are living at a time when CO_2 is the lowest it has been for billions of years, we continue to remove CO_2 via carbonate sedimentation from the oceans and the oceans continue to be buffered by water-rock reactions (as shown by Walker et al. 1981).

The literature on this subject is large yet the warmers chose to ignore this literature.

These feldspar and silicate buffering reactions are well understood, there is a huge amount of thermodynamic data on these reactions and they just happened to be omitted from argument by the warmers.

When ocean pH changes, the carbon species responds and in more acid oceans CO_2 as a dissolved gas becomes more abundant.

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$$CO_2 + H_2O = H_2CO_3$$
$$H_2CO_3 = H^+ + HCO_3^-$$
$$2Ca^{2+} + 2HCO_3^- + KAl_2AlSi_3O_{10}(OH)_2 + 4H_2O = 3Al^{3+} + K^+ + 6SiO_2 + 12H_2O$$
$$2KAlSi_3O_8 + 2H^+ + H_2O = Al_2Si_2O_5(OH)_4 + 2K^+ + 4SiO_2$$
$$2NaAlSi_3O_8 + 2H^+ + H_2O = Al_2Si_2O_5(OH)_4 + 2K^+ + 4SiO_2$$
$$CaAl_2Si_2O_8 + 2H^+ + H_2O = Al_2Si_2O_5(OH)_4 + Ca^{2+}$$
$$KAl_2AlSi_3O_{10}(OH)_2 + 3Si(OH)_4 + 10H^+ = 3Al^{3+} + K^+ + 6SiO_2 + 12H_2O$$
$$CO_2 + CaSiO_3 = CaCO_3 + SiO_2$$
$$CO_2 + FeSiO_3 = FeCO_3 + SiO_2$$
$$CO_2 + MgSiO_3 = MgCO_3 + SiO_2$$

In the oceans, CO_2 exists as dissolved gas (1%), HCO_3^- (93%) and CO_3^{2-} (8%)