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A Geochemical Approach to Global Warming? Options

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[arcolo...@aol.com](#) [View profile](#)

[More options](#) Feb 4, 11:31 am

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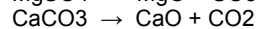
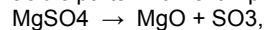
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in its early existence. This early molten planet, we should expect, separated out into a "basic" interior and an outer lighter, partially gaseous, "acidic" layer. The core and the mantle should largely retain this structure while the crust and atmosphere have been modified by biological processes

to a somewhat less acidic state involving formation of free oxygen and some reduced materials like coal and hydrocarbons.

Now, we are undoing millions of years of biological effort by burning up fossil energy stores in a few hundred years and re-acidifying the surface of the planet in the process. Atmospheric CO2 now stands at an unprecedented 390 ppm and the oceans are becoming dangerously acidic, interfering with biological cycles. Of course we know we should stop making CO2. We will eventually do that but it will be too late when we actually get serious about it. (It's really too late now.) As I see it, a logical "solution" to consider is to seek to recombine basic materials found in the mantle with the excess CO2 in the biosphere. Can that practically be done? To have a meaningful effect, a way must be found to release enough basic material to absorb 1×10^{14} kg of CO2 per year. That is, about 5×10^{12} kilogram equivalents of basic mineral per year.

From here on, I am speculating. Could it be possible to stimulate enough eruptions of submarine volcanoes to discharge the required amount of basic mineral into the deep ocean? What amount (chemical equivalents) of base can we expect the magma to contain and how much of it might be exposed to react with the CO2-rich water? The heat from the magma plus heat from the acid-base reaction will cause a large upwelling of deep (more basic) sea water to the surface. This basic water would then remove CO2 from the atmosphere

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on a short time scale. Note that deep ocean water is already relatively basic because it has a much lower concentration of CO₂ (and bicarbonate) than presently at the surface. That is because the deep water was put in place in earlier millennia when atmospheric CO₂ was at about 280 ppm or less. Conceivably, a substantial reduction in atmospheric CO₂ could occur even without the basic mineral.

Now, one more factor to consider—deep ocean water naturally contains an abundance of plant nutrients such as nitrogen and phosphorus. Mantle material can add other key "phytonutrients," in particular, iron and silicon. The result is the possibility that the upwelling flows will enrich the surface ocean water for an extended period, thus increasing biological production. Possible benefits are further absorption of CO₂ (from biological activity) plus some added food production in the oceans.

Stating the Problem

The world is currently using 408 quadrillion BTUs of energy per year. Eighty percent of that energy is obtained by burning fossil fuels and releasing carbon dioxide into the atmosphere. Global emissions are estimated to be 3×10^{13} kg of CO₂ per year. While experts tell us we should cut emissions by 80% by 2050, so far there has been no slowing, but rather further increases. The CO₂ level in the atmosphere continues to rise.

CO₂ in the atmosphere is now at 390 ppm molar concentration at mountaintop level, or just a little less. This translates to about 3×10^{15} kg of CO₂ in the global atmosphere. Climatologists are telling us that the atmospheric concentration must be lowered to 350 ppm if we are to avoid catastrophic climate change.

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At present, there is no obvious way to achieve even this modest goal—but that isn't enough. There is very nearly a chemical equilibrium between atmospheric CO₂ and the CO₂ dissolved in the top 200 meters of the oceans, with a relaxation time believed to be less than one year. (Need a reference here.) For every kilogram of CO₂ removed from the atmosphere, another 1 to 1.5 kilograms of CO₂ will have been given up and removed from the oceans (because of the equilibrium reaction). With this added burden, the amount of CO₂ to be removed is about 7×10^{14} kg of CO₂, and it doesn't matter whether the CO₂ is removed from the atmosphere or from the top layer of the oceans, the effect is the same. Whatever the removal process is, to work in the near-term it will have to be rapid, of the order of 1×10^{14} kg per year, or it will be overwhelmed by the rate of emissions, which will not drop significantly in the near term, more likely it will increase.

Conclusion: We need a way to remove about 1×10^{14} kg of CO₂ from the (air or ocean) every year for at least 10 years. Our lives may depend on it.

It is proposed that we seek an engineering solution involving the purposeful release of basic materials (e.g., magma) into the deep ocean basins.

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Andrew Lockley [View profile](#)

[More options](#) Feb 4, 4:34 pm

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Even if you could get the rock out of the mantle, there's nothing to suggest it would come out in an easily-reactive form. Adjusting the weathering of existing rock - for example by promoting frost shatter - may be a more successful approach. However, this has also been analysed and has been

considered to be impractical.

A

On 4 February 2010 19:31, <Arcolo...@aol.com> wrote:

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Eugene I. Gordon [View profile](#) [More options](#) Feb 4, 5:21 pm

I speculate that if we could remove 1×10^{14} kg of CO₂ in one year or even half that amount for one year it would be extremely valuable as a scientific tool. We need a way to determine the temperature change associated with an increase in CO₂. There is no doubt adding CO₂ will increase global average temperature but no one knows for sure how much because there are other related parameters and some fundamental parameters like sunspots; and the net dependence of temperature on CO₂ concentration is the critical issue in climate science. Feedback is another issue being debated. If that basic relationship can be determined in a scientifically acceptable manner by a credible experiment it would essentially end the debate and it would be clear what must be done. So the issue is how to do such an experiment. It must be done rapidly so that all other phenomena that impact global average surface temperature but are also sensitive to changes in global temperature do not have a chance to respond and influence. This would confirm the basic greenhouse relationship since all the other parameters that influence temperature would not have time to change and modify the temperature. Then by following the temperature changes after the CO₂ level is stabilized one can determine the influence of the other parameters even if it is not clear exactly what and how much is actually changing. In the end the relationship independent of sunspot changes emerges.

-gene

From: climateintervention@googlegroups.com
[mailto:climateintervention@googlegroups.com] On Behalf Of Andrew Lockley
Sent: Thursday, February 04, 2010 7:35 PM
To: arcolo...@aol.com
Cc: climateintervention@googlegroups.com
Subject: Re: [clim] A Geochemical Approach to Global Warming?

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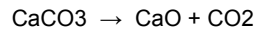
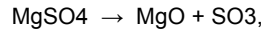
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[arcolo...@aol.com](#) [View profile](#)

[More options](#) Feb 4, 9:43 pm

Hello, Andrew,

Well, I can't disagree with your observations. I was hoping to get some advice somewhere on how to trigger an eruption of sufficient size. Lacking such information, I went ahead and calculated the size of eruption that would be needed to reach the desired scale of absorbing 1×10^{14} kg of CO2. Result: It would require triggering of hundreds of volcanoes of medium size, all discharging ultrabasic magma. OR triggering of one supervolcano.

A supervolcano is roughly one scoring a volcanic eruption index of VEI-8,

which discharges at least 1000 cubic kilometers of magma. The density of the desired magma is about 3000 kg /cu.meter. From this, the mass of magma from a supervolcano eruption is about 3×10^{15} kg. I estimated the base equivalent weight of ultrabasic magma to be 100 kg (assuming 20% MgO composition). Dividing gives 3×10^{13} kilogram equivalents from the eruption.

That

compares to a desired amount of 5×10^{12} to absorb the CO₂ -- that's a pretty good match considering the process will be very inefficient.

OH, MY! I guess I didn't fully realize the magnitude of the problem!
Eruption of a supervolcano, even at the bottom of the ocean, carries as much risk of annihilating us as does the atmospheric CO₂.

Still, the "solution," even if totally impractical, at least has the quality of being nearly big enough to do the job. And it's a reminder that we are playing a risky game on a planetary scale.

Ernie Rogers

In a message dated 2/4/2010 5:34:47 P.M. Mountain Standard Time,

andrew.lock...@gmail.com writes:

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Peter L Ward [View profile](#) [More options](#) Feb 5, 2:11 pm

CO2 is second most voluminous gas erupted by volcanoes after water. The volcano Pinatubo erupted in 1991 up to 921 Mt water, 234 Mt CO2, and only 19 Mt SO2. The rate of increase in the atmospheric concentration of CO2 actually slowed temporarily after the eruption because of global cooling for three years and therefore slight cooling of the ocean. But warming resumed as did the rate of increase in CO2 helped very slightly by the newly added CO2.

Secondly, the colder the ocean, the more CO2 it can hold. If you heat the ocean via large submarine volcanic eruptions, you increase atmospheric CO2.

Peter

On Feb 4, 10:43 pm, Arcolo...@aol.com wrote:

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Mike MacCracken [View profile](#) [Translate to English](#) [More options](#) Feb 6, 11:46 am

Aside from the triggering issue, it would be interesting to know if the formation of something like one of the Hawaiian islands or the ongoing formation of Iceland took out carbon at a rate that is near to what is being discussed. Related to removing carbon now as a result of island formation, it would be interesting to know if there might have been effects from this in the past. That is could island formation be something that should be considered an occasional factor in the carbon budget.

Mike MacCracken

On 2/5/10 12:43 AM, "Arcolo...@aol.com" <Arcolo...@aol.com> wrote:

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