Atmospheric Carbon Dioxide [1]

Last edit: 14 June 2026
Robert A. Beatty BE (Minerals) FAusIMM
BobBeatty@bosmin.com

ABSTRACT
It appears that atmospheric CO_2 is diminishing on Earth at an alarming rate. This is occurring because CO_2 automatically forms into limestone ($CaCO_3$) over time. This effectively secretes CO_2 in a none accessible form until the plant growing aspects of CO_2 diminish to the point of extinction. The process can be reversed by heating the limestone, and thereby liberating CO_2 back into the atmosphere. This can be done most efficiently, using nuclear energy. The remaining CaO can be secreted suitable for long term storage by combining with silicon oxide (sand).

1) Introduction:

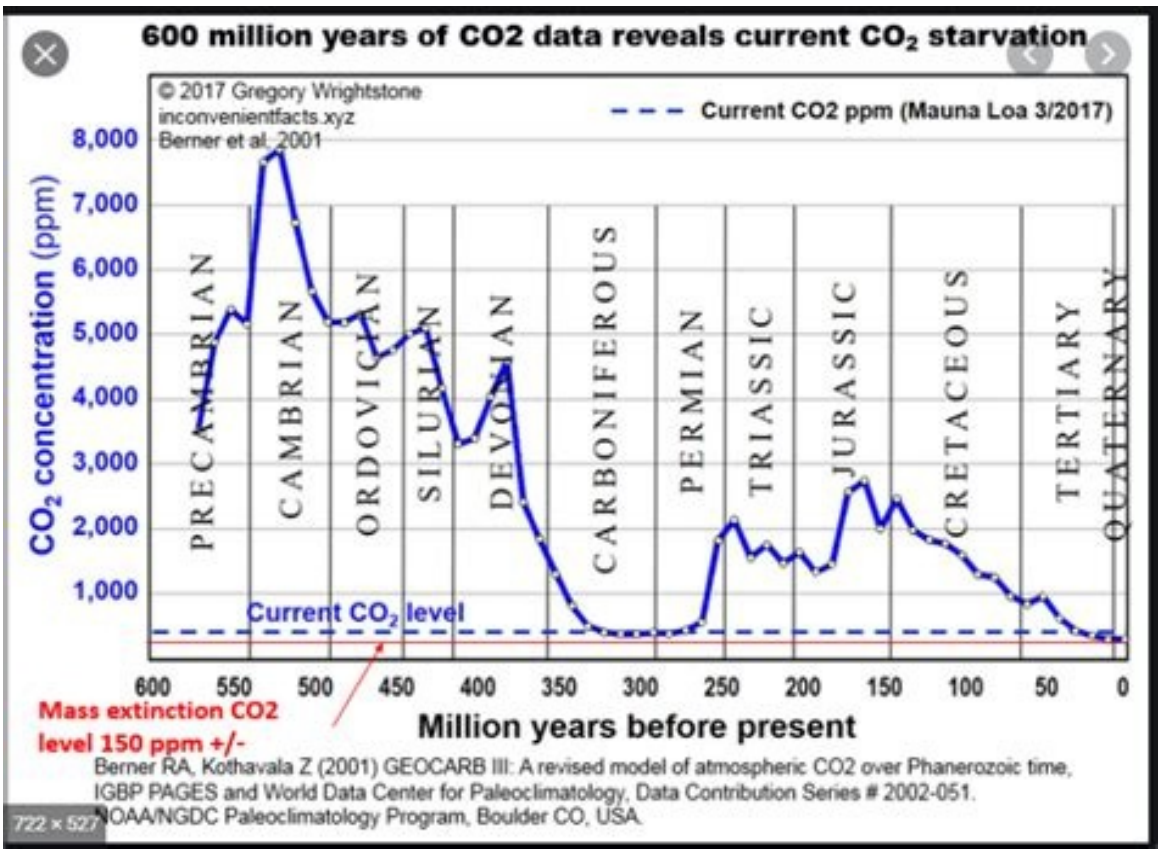

Figure 1.[2]
Marc Marano - "In Geological Terms, Today's Atmospheric CO2 Concentrations Are Still Uncomfortably Low"

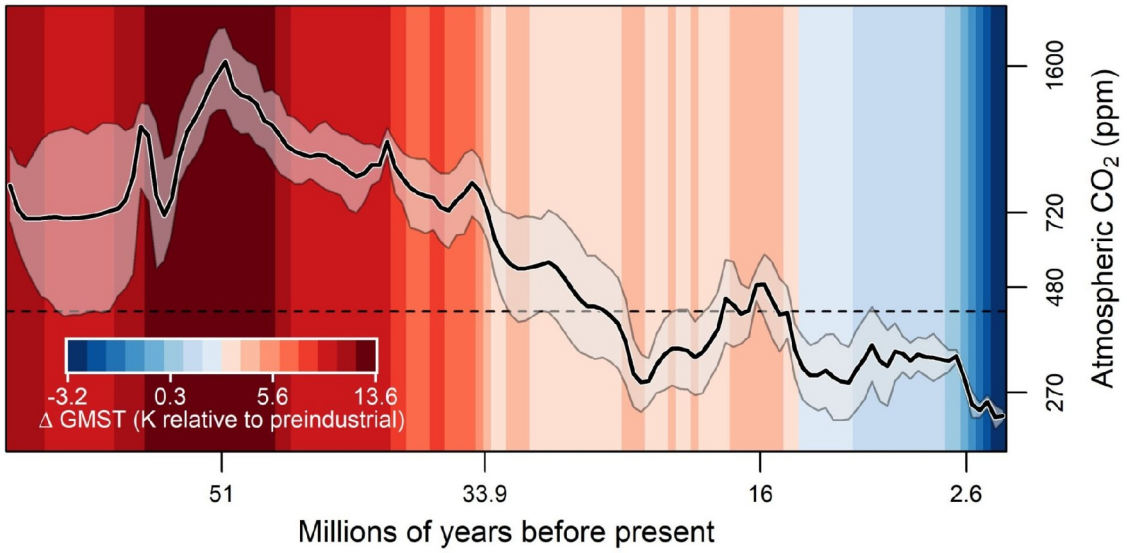

Figure 2.[3]
Grey region represents the level of uncertainty in the reported figures.
These findings fit with the document, Planets, Satellites and Landforms.[4]

And.

Australian Age of Dinosaurs, via Winton, Queensland.[5]

"The Museum tour includes two tours spread across two unique facilities. In the most productive Fossil Preparation Laboratory in the Southern Hemisphere, visitors learn how fossils are discovered, watch as fossils are prepared and touch a real dinosaur bone."

Figure 3

2) Limestone:

It is defined in Wikipedia as:

> Limestone is a type of carbonate sedimentary rock which is the main source of the material lime. It is composed mostly of the minerals calcite and aragonite, which are different crystal forms of calcium carbonate $CaCO_3$. Limestone forms when these minerals precipitate out of water containing dissolved calcium. This can take place through both biological and non biological processes, though biological processes, such as the accumulation of corals and shells in the sea, have likely been more important for the last 540 million years. Limestone often contains fossils which provide scientists with information on ancient environments and on the evolution of life.
>
> About 20% to 25% of sedimentary rock is carbonate rock, and most of this is limestone. The remaining carbonate rock is mostly dolomite, a closely related rock, which contains a high percentage of the mineral dolomite, $CaMg(CO_3)_2$. Magnesian (Magnesium) limestone is an obsolete and poorly defined term used variously for dolomite, for limestone containing significant dolomite (dolomitic limestone), or for any other limestone containing a significant percentage of magnesium. Most limestone was formed in shallow marine environments, such as continental shelves or platforms, though smaller amounts were formed in many other environments. Much dolomite is secondary dolomite, formed by chemical alteration of limestone. Limestone is exposed over large regions of the Earth's surface, and because limestone is slightly soluble in rainwater, these exposures often are eroded to become karst landscapes. Most cave systems are found in limestone bedrock.
>
> Limestone has numerous uses: as a chemical feedstock for the production of lime used for cement (an essential component of concrete), as aggregate for the base of roads, as white pigment or filler in products such as toothpaste or paint, as a soil conditioner, and as a popular decorative addition to rock gardens. Limestone formations contain about 30% of the world's petroleum reservoirs.

2) Calcium Silicate:

It is referred to in Wikipedia as:

> Calcium silicate can refer to several silicates of calcium including:
> $CaO{\cdot}SiO_2$, wollastonite ($CaSiO_3$)
> $2CaO{\cdot}SiO_2$, larnite (Ca_2SiO_4)
> $3CaO{\cdot}SiO_2$, alite or (Ca_3SiO_5)
> $3CaO{\cdot}2SiO_2$, ($Ca_3Si_2O_7$).
> This article focuses on Ca_2SiO_4, also known as calcium orthosilicate, or by the shortened trade name Cal-Sil/Calsil. All calcium silicates are white free-flowing powders. Being strong, cheap and nontoxic, they are components of important structural materials.

Larnite is a calcium silicate mineral and a member of the olivine group of minerals. It has a stable temperature range of 520-670 ºC, and is commonly found in Portland cement. Wollastonite features the highest melting point at up to 2,000 ºC, but is more expensive to produce.

3) Global Volume Requirements:
To produce enough CO_2 to equate to the current absorption rate of CO_2 we need to secrete a total of 35 billion tonnes (35,000,000,000,000 kg) each year.

Coastal Habitats	Estimated Area (sq ml)	Estimated Depth (m)	Volume (m_3)
Continental shelf	57,000,000x35%	0.00275 m	54,862.5 (m_3)
Open sea floor	303,000,000x0.93	0.35 m	98,626,500 (m_3)
		Total	98,681,362 (m_3)

Density of CO_2 is 1.977 kg/m_3 gives 195,093,053 kg each year.

The majority of carbonate deposit is calculated from Henry's Law deposit of CaO_3 in the deep oceans.[6]

4) Larnite Energy Requirements:
To convert 1 kg/yr of CO_2 to Larnite takes approximately 3.24 megajoules (MJ/kg).

The total CO_2 per year is 3.24 x 195,098,053 x (520ºC-20ºC) = 315,000,000,000 MJ/pa.

Nuclear energy reactors produce between 581 MJ (R.E. Ginna) and 3,937 MJ (Palo Verde) of energy per year. Both plants can produce about 18,350,000,000 MJ/pa depending on their operating capacity.

So; 315,000,000,000 / 18,350,000,000 = 17.2 nuclear plant will suffice to convert the required quantity of Sandstone to Larnite.

Approximately 1t of nuclear fuel (U-235) produces sufficient 144,000,000 (MJ) of energy. So requirement calls for 315,000,000,000 / 144,000,000 = 2,187.5t of uranium.

5) Wollastonite Energy Requirements:
To convert 1kg of Larnite to Wollastonite takes a further 0.77 MJ/kg of nuclear fuel.
So; total CO_2 per year is
(3.24+0.77=4.01) x 195,098,053 x (520ºC-2,000ºC=1480ºC) = 1,157,867,992,494 MJ/pa.

So; 1,157,867,992,494 / 18,350,000,000 = 63 nuclear plant will suffice to convert the required quantity of Sandstone to Wollastonite.

Existing CO_2 contributions from India, China and Indonesia do not alter these figures much.

The Australian plus economic zone, portion of this quantity is 8.15/510.1 = 1.6% of this quantity. By proportion, Australia's responsibility is 0.28 nuclear plants for Larnite and 1.0 plants for Wollastonite.

6) Keywords:
Larnite, Wollastonite, limestone, calcium oxide, Climate Depot, Utah, CopyRight, BOSMIN, Winton

7) References:

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