

Rapid CO₂ Absorption with Mineralization of CO₂ by OLIVINE. 2016/8/6

80%CO₂ cut with **mass absorption** by ocean and land would take more than 60 years long, while Olivine Engineering in global reservoir could have potential of **rapid absorption** .

[0]: Distribution of Carbon on Earth.

Almost GLOBAL CO₂ has been being stably confined within **rocks**.

| | Amount (x 10 ¹⁵ kg) | Relative amount (%) |
|---------------------------------|--------------------------------|---------------------|
| Limestones (CaCO ₃) | 35.000 | 46.6 % |
| Dolomites | 25.000 | 33.3 % |
| Sedimentary carbon | 15.000 | 20 % |
| Recoverable fossil fuels | 4 | 0.005 |
| Oceanic CO ₂ | 42 | 0.056 |
| Atmospheric CO ₂ | 3 | 0.004 |
| Biomass | 0.056 | 0.0007 |
| Anthropogenic emission | 0.03 /year | |
| Input from Earth's interior | 0.0025/year | |

Table 1: Distribution of carbon on Earth. Modified after Dunsmore (1992)

<http://www.innovationconcepts.eu/res/literatuurSchuiling/olivineagainstclimatechange23.pdf>

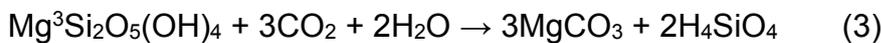
[1]: Chemical Reactions of Mineralisation of CO₂ by OLIVINE.

<http://www.carbonorder.com/atmospheric-c02-reduction>

Carbonation is a **natural process** where CO₂ reacts with different minerals forming solid precipitates leading to the **weathering of the rocks**.



$$(24 \times 2 + 28 + 16 \times 4) : 2(12 + 16 \times 2) = 140 : 88$$



Due to the abundance of silicates around the world, the storage capacity of mineral carbonation is very large (>**10,000 GtC**) . Note atmospheric carbon is **850GtC(400ppm)** at now.

☞ : OMAN: 70,000km³ of 30% olivine; sufficient to mineralise centuries of global CO₂ emissions.

$$M = 70000(1000\text{m}^3) \times 0.3 \times 3.5\text{ton/m}^3 = 7.35 \times 10^{12}\text{ton}. \quad \langle \text{olivine density} \sim 3.5\text{ton/m}^3 \rangle.$$

http://www.cmclinovations.com/wp-content/uploads/2013/06/CCC_Biomass-Power-CCS_24-5-13.pdf

Olivine weathering to capture CO₂ and counter climate change

<http://arctic-news.blogspot.jp/2016/07/olivine-weathering-to-capture-co2-and-counter-climate-change.html>

Only process that has always removed the excess of CO₂ emitted by volcanoes since the origin of the Earth is barely considered. It is the weathering of minerals by which almost all the CO₂ that was emitted during the past by volcanoes was transported as *bicarbonate solutions* to the oceans where it was sustainably stored as carbonate rocks (limestones and dolomites).

“Mineral Carbonation: a stand-alone option for Biomass CCS”

http://www.cmclinnovations.com/wp-content/uploads/2013/06/CCC_Biomass-Power-CCS_24-5-13.pdf

[2]: Rapid Accomplishing Stable Climate by Olivine Engineering.

Global Carbon Budget 2015.

| emitter | absorber |
|---|---|
| Man-made = 33.0 ± 1.8 GtCO ₂ /yr 91% | Ocean = 9.5 ± 1.8 GtCO ₂ /yr 26% |
| Natural = 3.4 ± 1.8 GtCO ₂ /yr 9% | Land = 10.9 ± 2.9 GtCO ₂ /yr 30% |
| | Atmosphere = 16.0 ± 0.4 GtCO ₂ /yr 44% |

<http://www.globalcarbonproject.org/carbonbudget/15/presentation.htm>

http://www.globalcarbonproject.org/carbonbudget/15/files/GCP_budget_2015_v1.02.pdf

(1) How much each of us (7 billion) emit CO₂ /year ?.

$$33 \times 10^9 \text{t} / 7 \times 10^9 \text{p} = 4.7 \text{t/p.year} = 12.9 \text{Kg/p.day.}$$

(2) How much Olivine need to absorb 33 Gt CO₂/year ?.

Chemical ratio of CO₂ and Olivine → [1]:(2)

$$88 : 140 = 33 \text{Gt} : 53 \text{Gt.} \rightarrow 53 \text{Gt} / 7 \times 10^9 \times 365 = 21 \text{Kg/p.day.}$$

☞: Thus if you absorb CO₂ by above olivine, you could cancel CO₂ emitting. You must mill

21 Kg olivine rock/day, it is **NOT IMPOSSIBLE** if you get olivine and hammer.

Massive **DAC plants** (direct air capture CO₂) could those by industrial ways.

<http://www.carbonorder.com/atmospheric-co2-reduction>

*If no hazardous, milling & spreading mass olivine could be done by dynamite in mine ?.

At now, author do not well know about details of **olivine engineering** due to his indulgence.

(3) Both 80% CO₂ cut and mass absorption by olivine are possible, which enable rapid decrease of atmospheric CO₂ by {3.4 + 0.8 × 33 - 9.5 - 10.9 - 33} = -23.6 GtCO₂/year.

$$-23.6 \text{GtCO}_2/\text{year} = -3 \text{ppm/y.}$$

*7.8 Gt CO₂ per ppm

(4) **Stable concentration 350ppm? could be accomplished by $(400-350)/3=17$ years !!.**

Following are **Global Temperature Change** simulations by **CO2 Sink Scenario**.

<http://www.777true.net/Accounting-principle-verify-reconstruction-the-Past-Climate-Records.pdf>

Above all, **below 0.2°C rise** would be best for evading possible dangerous climate disasters.

This is temperature change by 3ppm sink **both by 80%cut and olivine engineering.**

