Mitigation of CO₂ emissions by stimulated natural rock weathering – fast weathering of olivine in high-energy shallow seas

Human CO₂ emissions (2014): 36 GT
Natural CO₂ emissions: 0.5 – 1 Gt
In order to restore the balance, natural rock weathering must be greatly stimulated
Annual consumption of hydrocarbons (in oil equivalents): 10 km³

This can be compensated by stimulated weathering of 7 km³ olivine

Experiment: A week shaking of olivine in fresh water on a top table rotary shaker; water becomes milky by suspended olivine particles; and grains are rounded; pH rises to above 8.

Experiment with olivine in a large recirculating flume; when water flows and olivine is transported, pH rises from 8.05 to 8.3; pH drops to ~8.1 when current is stopped.

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<th>Flume video 1</th>
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Olivine occurrences

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- In the reaction: Mg₃Si₂O₅(OH)₄ (olivine) + 4 H₂O → 2 MgFe²⁺ + 4 OH⁻ + H₄SiO₄

- Some 1000 megacarriers would be needed to continuously carry olivine from mining areas to nearby high-energetic seas for the compensation of worldwide CO₂ emissions. This 5% exceeds the combined annual CO₂ emissions of the adjacent countries, the United Kingdom, France, The Netherlands, Belgium and Ireland, which together are responsible for about 4% of the world's CO₂ emissions.

- This is a far safer and cheaper approach than CCS. Moreover, contrary to CCS, adding olivine to the marine system, in areas where it weatheres fast, is an effective way to counteract ocean acidification. Bio-limiting nutrients brought into the system, Si and Fe, will moreover stimulate primary productivity thus trapping even more CO₂.

- Can they help?
Weathering in the intestines of lugworms: acceleration 2 to 3 orders of magnitude that is 100 – 1000 times faster …

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