

## Potential consequences of element release from Enhanced Weathering

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The application of rock flour on suitable land (“Enhanced Weathering”) is one proposed strategy to reduce the increase of atmospheric CO<sub>2</sub> concentrations. Investigations of this method focused on the impact on the carbonate system, as well as on engineering aspects of a large-scale application, but potential side effects were never discussed quantitatively.

We analysed about 120,000 geochemically characterised volcanic rock samples from the literature. Applying basic statistics, theoretical release rates of nutrients and potential contaminants by Enhanced Weathering were evaluated for typical rock types.

Highest heavy metal concentrations are found in (ultra-) basic rocks, the class with the highest CO<sub>2</sub> drawdown potential. More acidic rocks contain less or no critical amounts, but sequester less CO<sub>2</sub>. The applied rock material can contain significant amounts of essential or beneficial nutrients (potassium, phosphorus, micronutrients). Their release can partly cover the demand of major crops like wheat, rice or corn, thereby increasing crop yield on degraded soils. However, the concentrations of considered elements are variable within a specific rock type, depending on the geological setting.

Findings show that the rock selection determines the capability to release critical amounts of potentially harmful elements, or to supply significant amounts of nutrients, which could partly substitute industrial mineral fertiliser usage. Through careful selection of regionally available rocks, benefits could be maximised and drawbacks reduced. The deployment of Enhanced Weathering to sequester CO<sub>2</sub> and ameliorate soils necessitates an ecosystem management, considering the release and fate of weathered elements in plants, soils and water. Other CDR strategies, like afforestation, biofuel production, and biochar application could benefit from Enhanced Weathering side effects and should be considered as a set of tools that could be jointly applied.