



Feasibility Study of Enhanced Mineralization Based on LCA/TEA Platform

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Summary

The objective of this project is development of a LCA/TEA platform to optimize the total system of enhanced mineralization (EM), which is to capture atmospheric CO₂ by rocks (such as mafic rocks) weathering and accelerate plant growth. Current recommendations of EM are following: (1) CO₂ accounting - Accurate CO₂ reductions cannot be accounted, and effects are unknown, (2) Application of EM - No empirical data on utilization of mafic, basaltic rocks and others, and (3) Costs reduction - Slow reaction, economically disadvantageous. By resolving these issues, this project aims to make a significant contribution to the development of fundamental technologies for the social implementation of EM.

Development of “mafic rocks database” and the CO₂ fixation measurement technology:

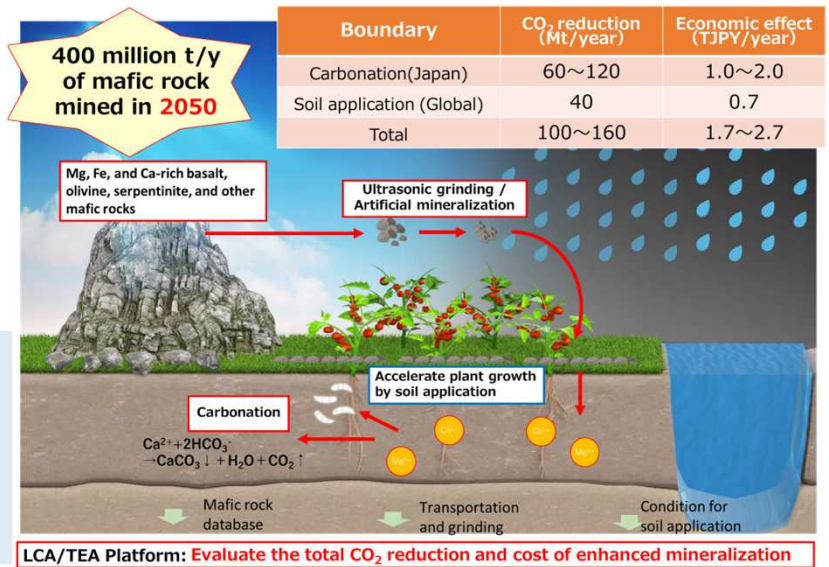
For accurate accounting of CO₂ reduction by EM, the mafic rock database will be developed in Japan which includes chemical and mineral compositions, mining site, etc. In addition, CO₂ absorption under various control conditions will be assessed, such as laboratory, long-term outdoor exposure conditions, and soil conditions.

Analysis for the effect of applying rocks powder to soil on plant growth and microbiome diversity:

The growth of various plants will be analyzed, as well as the effect of CO₂ fixation in different soil environment such as pH and microbial activity in soil by mafic rock powder. To optimize the EM applied plant growth system, rock particle size and plant species will be optimized which is suitable for plant growth using RIPPS (RIKEN Integrated Plant Phenotyping System) and cultivation trial.

Development of the technology for accelerated EM and LCA/TEA platform of EM

To reduce the CO₂ mineralization costs and energy consumption, technologies were developed such as an ultrasonic pulverization method and an engineering accelerated EM (e.g., reaction pH control using by electricity). By incorporating the developed technologies and data into LCA/TEA platform, system optimization will be conducted for the application of EM.



Outline of the project

- ◆ Accurate accounting of CO₂ reductions.
- ◆ Clarify the optimal soil application method of mafic rocks for plant growth.
- ◆ Development of cost reducing technologies.
- ◆ Development of LCA/TEA platform.

KPI

FY2024

- ◆ Accurate accounting of CO₂ reductions by developing the database of mafic rocks and the CO₂ fixation measurement technology.
- ◆ CO₂ mineralization more than 10 times faster than the current process by innovative mineral crushing technology and industrial reaction accelerated method.
- ◆ Realization of EM by using mafic rocks as a plant growth promoter.
- ◆ Development of the LCA/TEA platform and cost-optimized total system design from mineral mining to carbonate utilization.

Implementation

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