Water Alternating Gas Cycling to Optimize CO₂ Mineralization for Geological Carbon Storage: Cascadia Project

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INTRODUCTION

Sub-ocean basalt rock formations provide enormous storage capacity for secure and safe storage of CO₂ in mineralized form. Two recently completed field injection projects, CarbFix in Iceland, and Wallula in Washington State, have both shown a rapid mineralization of CO₂ into stable carbonate in basalt formations. CarbFix injected fully dissolved CO₂ in fresh water (25:1 water ratio by volume) and documented >95% carbon mineralization in basalt within 2 years. Similarly, Wallula injected pure liquid CO₂ into basin and documented carbon mineralization within 2 years.

As tested in the CarbFix project, various injection strategies involving co- or alternating-injection of CO₂ and water into basalt reservoirs may improve the mineralization of thermodynamically stable carbon solid phases. In addition, these strategies may help maximize injection volumes, minimize energy needs for pumping, and improve operational efficiencies.

CASCADIA PROJECT LOCATION

Targeted injection formation for the project is the sub-ocean basalt basement in the Juan de Fuca ridge, a few hundred kilometers west of Vancouver Island, Oregon, and Washington:

- Highly fractured, channelized, and porous (10-15%)
- Sealed by impermeable fine-grained turbidities and hemipelagic clay sediments.
- Comprises both pillow lavas and massive flows containing plagioclase, olivine, and clinopyroxene.

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