Technology Development, Field Assessments and Modelling Efforts for Sub-Seabed Basalt Storage of Carbon Dioxide on the Reykjanes Ridge, Mid-Atlantic Ocean

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To meet temperature goals that limit warming to well below 2°C requires the removal of hundreds of billions of tonnes of CO₂ from the atmosphere over the course of this century. Effective Carbon Dioxide Removal (CDR) methodologies will be required to reduce net emissions in the near term, counterbalance residual CO₂ emissions to achieve net-zero in the medium term, and contribute to net-negative emissions in the longer term— all of this in a sustainable and safe manner.

The AIMS³ project (www.aims3.cdrmare.de) will deliver new insights, monitoring tools and feasibility assessments for CO₂ storage at oceanic Carbon Capture and Storage (CCS) sites, specifically in basaltic rocks of the oceanic crust. The study forms a distinct progression of CO₂ injection experiments carried out before (Sleipner gas release experiment, EU STEMM-CCS project, etc.) in former coastal subseafloor reservoirs or saline aquifers. Instead, AIMS³ focuses on the flanks of mid-ocean ridges where porous basaltic crust is overlain by thin sediment successions of low permeability as a cap. These basalts react quickly with injected CO₂ (dissolved, liquid, or supercritical), which is fixed effectively in carbonate minerals without the risk of a later escape, ideally in deep water environments. Inflow of cold seawater and discharge of warmed hydrothermal fluids are focused and directed at such sites and help dispersing CO₂ into wider areas, hence requiring fewer injection sites in case of future storage activities.

The talk will present ongoing work at the Reykjanes Ridge south of Iceland. Together with industrial partners, AIMS³ is currently setting up a ridge flank observatory with a transect of boreholes through the fill of young sediment ponds into the upper oceanic crust. The boreholes are equipped with observatories, which will include a suite of cost-effective sensors, landers and robots to identify and quantify CO₂ with high precision and accuracy. Here we outline the rationale of AIMS³, provide an overview of the activities, and highlight some of the expedition results, with the goal to stimulate communication and collaboration.

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