The Potential For CO2 Disposal In The Volcanic Fields Of The Arabian Peninsula

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Abstract

Objectives/Scope: Disposal of industrial CO2 emissions is urgently needed to mitigate global warming. This study examines the potential of in-situ carbon dioxide (CO2) mineralization in the extensive Oligocene-Recent basalt lava fields on the Arabian Peninsula.

Methods, Procedures, Process: It focuses on assessing the viability of two CO2 sequestration techniques: injection of CO2 dissolved in water and injection of pure supercritical CO2. The first method requires over 400 meters of groundwater-saturated basalt with good permeability. An alternative method is the injection of pure supercritical CO2, which requires over 800 m of groundwater-saturated basalt and impermeable basalt seals. This study evaluates 23 volcanic fields scattered across Saudi Arabia, Syria, Jordan, and Yemen. These fields are divided into two categories — older and younger — each with distinct geological characteristics. Our evaluation of the suitability of these fields for CO2 mineralization includes their topography, geological setting, petrography, mineralogy, hydrogeology and proximity to industrial emissions of CO2.

Results, Observations, Conclusions: We conclude that most volcanic fields (20) are unsuitable for CO2 disposal due to insufficient basalt thickness and dry conditions — located above the local groundwater table. However, Harrat Rahat, Harrat ash Sham, and the Yemen Plateau have areas that contain thick groundwater-saturated basalts (>500 m) that are technically suitable for CO2 disposal.

Novel/Additive Information: This regional assessment provides the basis for focusing on these areas for potential CO2 mineralization projects.