



Serpentinite Carbonation in the Pollino Massif (southern Italy) for CO₂ Sequestration

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Anthropogenic gas emissions are projected to change future climates with potentially nontrivial impacts (Keller et al., 2008 and references therein) and the impacts of the increased CO₂ concentration are, among others, the greenhouse effect, the acidification of the surface of the ocean and the fertilization of ecosystems (e.g. Huijgen and Comans, 2003).

Geologic Sequestration into subsurface rock formations for long-term storage is part of a process frequently referred to as “carbon capture and storage” or CCS. A major strategy for the in situ geological sequestration of CO₂ involves the reaction of CO₂ with Mg-silicates, especially in the form of serpentinites, which are rocks: i) relatively abundant and widely distributed in the Earth’s crust, and ii) thermodynamically convenient for the formation of Mg-carbonates (e.g., Brown et al., 2011). In nature, carbonate minerals can form during serpentinization or during hydrothermal carbonation and weathering of serpentinites whereas industrial mineral carbonation processes are commonly represented by the reaction of olivine or serpentine with CO₂ to form magnesite + quartz ± H₂O (Power et al., 2013). Mineral carbonation occurs naturally in the subsurface as a result of fluid–rock interactions within serpentinite, which occur during serpentinization and carbonate alteration. In situ carbonation aims to promote these reactions by injecting CO₂ into porous, subsurface geological formations, such as serpentinite-hosted aquifers.

In the northern sector of the Pollino Massif (southern Italy) extensively occur serpentinites (Sansone et al., 2012) and serpentinite-hosted aquifers (Margiotta et al., 2012); both serpentinites and serpentinite-hosted aquifers are the subject of a comprehensive project devoted to their possible use for in situ geological sequestration of CO₂. The serpentinites derived from a lherzolithic and subordinately harzburgitic mantle, and are within tectonic slices in association with metadolerite dykes and medium to high-grade metamorphic rocks. Primary mantle minerals are olivine, clinopyroxene, orthopyroxene, and spinel whereas serpentine, magnetite, chlorite, and amphibole are pseudomorphous minerals. Olivine is replaced by serpentine forming a mesh texture and orthopyroxene is mostly altered to bastite. Water chemistry indicates serpentinites interact with meteoric water producing a Mg-HCO₃ type water in a system open to CO₂.

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