

POPULAR SCIENTIFIC SUMMARY

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DISPUTATION TITLE:	Carbonation of ultramafic rocks
DISSERTATION TITLE:	Carbonation of ultramafic rocks

Geological carbon storage has been proposed as a safe and permanent option for the mitigation of anthropogenic CO₂. Mafic and ultramafic rocks are particularly promising target rocks as their carbonation potential is high and interaction with CO₂-bearing fluids readily results in the formation of stable carbonate minerals. The objective of this doctoral thesis, is to explore the reaction mechanisms and their physico-chemical consequences in naturally carbonated ultramafic rocks. Three different settings are investigated comprising large-scale hydrothermal carbonation of serpentinite, carbonation during subarctic weathering of peridotite, and carbonation of serpentinitized and partly weathered peridotite within a sedimentary basin. The conducted research combines detailed field investigations, determination of whole rock and mineral major-, trace-element, and stable isotope compositions, He- and Hg-porosimetry, and thorough microtextural observations using optical and electron microscopy.

The study indicates that carbonation of serpentinite bodies at an elevated temperature (~270 °C) can proceed isovolumetrically, hence reducing the risk of pore space clogging during formation of the secondary carbonates. Exposure of fresh ultramafic material to surface weathering, as e.g. in mine shafts and tailings, efficiently takes up atmospheric CO₂ due to the formation of hydrous Mg-carbonate efflorescences (e.g. lansfordite, nesquehonite). The formation of hydrous Mg-carbonates is kinetically favoured relative to anhydrous magnesite (MgCO₃) and the observed reaction-induced fragmentation of the ultramafic substrate represents a positive feedback for the carbonation. The presence of partly weathered ultramafic detritus increases the CO₂ uptake potential of sedimentary basins as soluble weathered ultramafic material is preferentially carbonated relative to basaltic and felsic rocks.

The results of this doctoral thesis further the understanding of carbonation mechanisms in different settings and may contribute to the planning of in-situ and ex-situ mineral carbonation strategies for CO₂ mitigation in the future.