

# **The effect of ocean water sulfate on the carbonation of Lherzolite through CO<sub>2</sub>-Water-Rock interactions experiments**

TIAGO DE ABREU SIQUEIRA<sup>1</sup>, JOAO BERNARDO VARGAS<sup>2</sup>, ROMMULO VIEIRA CONCEICAO<sup>2</sup>, CAROLINE D K TOLLOT<sup>2</sup> AND VINICIUS H MARCON<sup>2</sup>

<sup>1</sup>Universidade Federal do Rio Grande do Sul

<sup>2</sup>UFRGS-PPGGEO-LAGEPE

Presenting Author: [abreu.t@gmail.com](mailto:abreu.t@gmail.com)

Among the various lithologies proposed for geological carbon storage, ultramafic mantle rocks demonstrate significant potential. This arises from the high reactivity of peridotites through hydrothermal reactions, their high concentration of divalent ions such as magnesium and iron, as well as the typical alkalization of the reactive fluid due to olivine dissolution. This set of attributes favors rapid reactions with high concentrations of newly formed carbonates such as magnesite and dolomite. Furthermore, a challenge for the implementation of carbon geological storage projects is the water source used in injection. To investigate the effect of sulfate present in oceanic source fluids during the hydrothermal carbonation of spinel lherzolites, four experiments were conducted using hydrothermal reactors, varying the presence of sulfate ion, as well as the duration of 5 or 30 days. After the experiments, solid, ionic, and gaseous products were analyzed through a series of analytical techniques, including Microprobe, Scanning Electron Microscope (SEM) with Energy Dispersive Spectroscopy (EDS) coupled, X-ray diffraction, X-ray fluorescence, Inductively Coupled Plasma Optical Emission Spectrometry, pH measurements, as well as Ion and Gas Chromatographies. The experimental results include compositional maps, pre- and post-experiment mineral chemistry, SEM images with associated EDS data, mineralogy, rock composition, pH values, as well as ionic and gaseous concentrations. The data obtained indicate an acceleration of dissolution and carbonation reactions in the presence of sulfate in the fluid due to its reduction to hydrogen sulfide, making the solution more acidic and dissolution rates faster. Moreover, the acceleration of initial mineral dissolution was shown to intensify the formation of reduced gases such as methane and hydrogen gas. This set of effects arises from iron oxidation reactions and the reduction of hydrogen ions from water, promoting modifications of the hydrothermal fluid's eH.